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TURNBULL (J.). **Orchard Spraying for commercial Growers.**—*Growmore Bull. Minist. Agric.* no. 9, 14 pp., 2 pls., 1 fig., 4 refs. London, H.M.S.O., 1943. Price 4*d.*

This bulletin deals mainly with modifications imposed by war conditions on commercial orchard spraying against insect and other pests in Britain ; increased yield of fruit is more important than complete freedom from blemish, and practices must be adjusted to the shortage of new machinery and spare parts and of labour. A section dealing with the care and maintenance of equipment is followed by one describing methods of making the best use of that available. This includes suggestions for suitable spraying dates and the quantities of spray required, an account of the factors affecting spray damage, and advice on the actual operations that spraying involves [*cf. R.A.E.*, A **28** 4] and on circumstances that cause variations in output. The importance of using every spraying plant that can be moved from farm to farm to its utmost capacity is emphasised, and the additional difficulties met with in work of this kind are discussed.

DUSTAN (G. G.). **Experiments on the Control of the Chrysanthemum Midge, *Diarthronomyia hypogaea* F. Lw.**—*Sci. Agric.* **23** no. 10 pp. 612–624. Ottawa, 1943.

The author gives a very short account of the life-history of *Diarthronomyia chrysanthemi*, Ahlberg (*hypogaea*, auct.), which has usually been controlled by spraying with nicotine every two days for six weeks or fumigating with nicotine or hydrocyanic acid gas every night for the same period [*cf. R.A.E.*, A **25** 389, etc.], and describes experiments carried out in Canada on potted chrysanthemums in the greenhouse to find an effective control programme that would entail fewer applications of insecticide. A proprietary spray concentrate containing 40 per cent. lauryl thiocyanate, 40 per cent. sulphated fatty matter and 20 per cent. inert ingredients was more effective than one containing 24 per cent. normal butyl carbitol thiocyanate or than sprays of nicotine sulphate or fixed nicotine in oil emulsion. Sprays of rotenone, bentonite in oil emulsion or the fixed nicotine alone gave no appreciable control. The rates of dilution given for the lauryl thiocyanate are the rates for the concentrate, not those for the thiocyanate itself. Under cage conditions, three applications of the spray diluted to 1 : 400 gave complete control when made at intervals of three days from 9th January or 4th March or at intervals of four days from 1st April. Some emergence occurred when only two applications were made, when only the upper surface of the leaves was sprayed or when the concentration of the spray was halved. It killed most of the larvae and pupae within the galls at a dilution of 1 : 400 and all eggs 2–3 days old at 1 : 400 or 1 : 600, and was more effective against these stages than the other materials tested. Only one adult emerged from 20 infested cuttings immersed in a dip of lauryl thiocyanate (1 : 800) for 10 seconds before planting, whereas 39 emerged from 20 immersed in the same dip with the addition of a spreader and 155 from 10 untreated plants.

In large-scale tests on plants on an open bench, four applications of the lauryl-thiocyanate spray at a concentration of 1 : 400 at intervals of 3–4 days, followed by four at 1 : 600 at weekly intervals, did not give complete control, probably because perfect coverage was not obtained, and similar results were observed under commercial conditions. It is therefore recommended that 3–4 additional applications at a concentration of 1 : 600 should be made at weekly intervals, more spray should be used and both the upper and lower surfaces of the leaves should be covered thoroughly, the latter by holding the spray nozzle about 6 ins. from the plants and pointing upward. The best time to treat the chrysanthemums is during the winter, after they are cut back and

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before the cuttings are made, because there is less foliage to cover at this time and any slight injury caused by the insecticide will soon be outgrown.

Treatment with sprays of nicotine sulphate or a preparation containing rotenone and pyrethrum at different times of day gave little difference in the reduction of emergence; one application of either kept it below normal for 48–72 hours. It is concluded that if these sprays are used, eradication would be more rapid if the plants were treated every day instead of every second or third day and that it is advisable, but not essential, to spray late in the day or during the evening.

RUDOLPH (B. A.). **A possible Relationship between the Walnut Erinose Mite and Walnut Blight.**—*Science* **98** no. 2550 pp. 430–431, 1 ref. Lancaster, Pa., 1943.

In the late summer of 1942, *Pseudomonas* (*Phytomonas*) *juglandis*, which causes bacterial blight of English walnuts [*Juglans regia*], with consequent considerable losses of nuts, throughout the world, was isolated from one of several examples of *Eriophyes tristriatus erineus*, Nal., found hibernating beneath the scales of a healthy, dormant bud on an English walnut tree in California. Cultures from this mite were inoculated into young seedling walnuts and produced lesions characteristic of walnut blight. In 1943, young shoots and nuts on mature trees were inoculated and also developed characteristic lesions, as did uninjured nuts on which broth suspensions of the bacteria were atomised. Controls in all cases remained healthy. If the mites can actually transmit the disease to the nuts, they may be the factor responsible for irregularities in the control of the disease with sprays, since these do not kill them. They are common on trees of all ages and produce galls on the foliage, but have hitherto been considered of no importance.

TURRELL (F. M.), CUNEO (F.), SLACK (D.) & CARNS (H.). **Factors in Injury to *Citrus* by Sulphur Dusts. A Progress Report.**—*Calif. Citrogr.* **28** no. 11 pp. 286–287, 302, 306–307, 310–311, 10 figs. Los Angeles, Calif., 1943.

In view of the fact that sulphur is one of the few materials used in insecticides and fungicides of which the supply is not likely to be limited by war requirements and that little is known of its physiological effect on *Citrus* plants, large-scale laboratory experiments were begun in California in 1939 to determine the constituents with which sulphur reacts in the fruit and what the by-products of these reactions are, and the effect of certain environmental factors on sulphur burn was investigated in the field. Most of the work was done with lemons, as they are known to be more susceptible to sulphur injury than oranges.

The following is based on the authors' summary. It has been shown that sulphur vaporises at ordinary air temperatures and that great increases in volatility occur with small rises in temperature. Penetration of the fruit peel by sulphur appears to be brought about by the action of high temperatures on solid sulphur particles on the surface. The sulphur vaporises and penetrates the rind in the gaseous phase, and when it enters the protoplasm, is reduced to hydrogen sulphide or oxidised to form a sulphate. Hydrogen sulphide is produced in larger quantities by sulphur-treated lemon fruit in spring than in summer. The production per unit time increases rapidly with increases in temperature from 90 to 120°F., and the total amount formed increases with temperatures up to 115°F. and then decreases. The gas will penetrate the rind and injure the fruit and may produce typical sulphur injury, but does not influence the vitamin C content of the fruit. It was not ascertained whether hydrogen sulphide is the cause of sulphur burn or simply a by-product indicative of an injurious preliminary reaction.

The intensity of sun radiation received by *Citrus* fruit and undissipated by reradiation or by conduction is one of the principal environmental factors influencing sulphur burn. High relative humidity, warm air and lack of air movement are secondary factors, but are of importance in causing it.

SNAPP (O. I.) & THOMSON jr. (J. R.). **Experiments with Oils and Lime-sulfur for the Control of the San Jose Scale on Peach Trees in the South.**—*Tech. Bull. U.S. Dep. Agric.* no. 852, 12 pp., 4 refs. Washington, D.C., 1943.

The authors describe further investigations on the control of *Quadraspidiotus* (*Aspidiotus*) *perniciosus*, Comst., on dormant peach trees [*cf. R.A.E.*, A **20** 18], carried out in Georgia in 1929–42. It was found that, at concentrations of 2 and 3 per cent., blended oils, prepared in the laboratory by combining different oils in trial tests until mixtures of the desired characteristics were obtained, were as effective as the single oils with which they were compared. Tests with 20 blended or single lubricating oils with almost the same viscosity and volatilities ranging from 0·3 to 13 per cent. [*cf. loc. cit.*], showed that oils with a volatility of not more than 1 per cent. are the most effective, and control was greatly reduced when oils with a volatility of 5–13 per cent. were used. In 3 per cent. emulsions, oils with viscosities of 55 and 85 Saybolt were rather less effective than those with viscosities of 110–145, and it is considered that oils with a viscosity lower than 125 should not be used ; in 2 per cent. emulsions, there was little difference between oils with viscosities of 220 and 370. Emulsions of wood-tar oil (viscosity 29, volatility 98·5 per cent.) were not effective, even an 8 per cent. emulsion giving only about 43 per cent. control [*cf.* **28** 285] and a mixture of 3 per cent. wood-tar oil and 1 per cent. mineral oil (265, 0·1 per cent.) gave less control than is usually obtained with 1 per cent. mineral oil emulsion used alone. No damage was caused to the trees. A mineral oil with a viscosity of 220 and volatility of 11·3 per cent. was as effective when emulsified with 3 lb. casein and 2 U.S. pints ammonia (28 per cent.) in 35 U.S. gals. water per 100 U.S. gals. oil and applied at concentrations of 2 and 3 per cent. as when emulsified with potash-fish-oil soap, and the former was somewhat easier to prepare and a little cheaper. Surveys made each year showed no sign of injury to the trees from 3 per cent. emulsions, none except retarded blooming in one year from 6 per cent. emulsions and none except slight injury in two years and retarded blooming in one from 8 per cent. A certain amount of damage was caused by 10 and 12 per cent. emulsions, though no trees were killed, and some severe injury by 15, 20 and 25 per cent. emulsions. Inspections for cumulative injury indicated that there was no danger from the continued use of 3 per cent. lubricating oil emulsion, applied once a year, and that applying two 3 per cent. oil sprays where necessary during the dormant season is probably safe.

Experiments carried out for five years indicated that 3 per cent. lubricating oil emulsion is somewhat more effective than lime-sulphur (1 : 7) [*cf.* **28** 284], though the latter is much more effective than it is usually thought to be. The apparent control of the scale with lime-sulphur increases between one and six months after spraying, so that the final count to determine its effectiveness should not be made for six months. Figures based on so late a count are given only for one season's work, when lime-sulphur in two experiments showed control percentages of 69·3 and 80 after three months and 98·7 and 99·6 after six, while oil emulsion showed 100 and 98·6 after two months. It appeared that lime-sulphur causes sterility of the mature females [*cf.* **29** 409], and prevents crawlers from settling as long as there is sufficient residue on the trees. The residue begins to weather within three or four months and is practically all gone by the end of eight.

Bobb (M. L.). **Ethylene Dichloride Emulsion and Paradichlorobenzene Crystals in Peach Tree Borer Control.**—*Bull. Va agric. Exp. Sta.* no. 347, 11 pp., 3 figs., 13 refs. Blacksburg, Va., 1943.

An account is given of experiments carried out in Virginia in 1939–42 to compare treatment with ethylene-dichloride emulsion and the standard treatment with paradichlorobenzene crystals, applied in a ring round the base of the trunk, for the control of the peach-tree borer [*Aegeria exitiosa*, Say]. Before treatment large masses of gum were removed from the base of the trunks, cracks in the ground were filled with soil and, in autumn, the surface of the soil was loosened. In a preliminary test in the autumn of 1938, treatment of two-year-old peach trees with ½, ¾ and 1 U.S. pint per tree of 15 per cent. emulsion gave complete control of the borers without damaging the trees; ¼ U.S. pint per tree (the recommended dosage [*cf. R.A.E.*, A **27** 256]) was not effective. Results obtained in the spring of 1939, when the emulsion was applied under pressure to the trunks of 15-year-old trees and the ground immediately surrounding them at concentrations of 15–25 per cent. and a rate of ½ U.S. pint per tree, showed that there was no appreciable difference in the percentage of borers killed with ethylene-dichloride emulsion applied during March, April or May or in trees that were mounded or not, and that all the treatments gave satisfactory control, concentrations of 20 and 25 per cent. being almost equally effective and 15 per cent. less so. Paradichlorobenzene (1 oz. per tree followed by mounding) was less effective when applied in March or April, when the soil temperature was below 60°F., but about as effective as the 20 per cent. emulsion in May. None of the treatments damaged the trees. In September 1939 and October 1940, when ½ U.S. pint emulsion was poured on the base of the trunks of trees 10–11 years old and the surrounding soil, there was again no difference between 20 and 25 per cent. emulsions, both of which gave satisfactory control, or between mounding or not mounding, and no tree injury occurred even when the concentration was increased to 50 per cent. in 1940. In October 1941, when the emulsion was poured on the soil, but not allowed to touch the trunks, and the trees were mounded, ½ U.S. pint of 15, 25 or 50 per cent. emulsion gave complete control on three-year-old trees, but the two higher concentrations caused some injury to the bark. In October 1942, when the soil was water-logged, ½ or 1 U.S. pint of 20, 50 or 85 per cent. emulsion gave complete control on 15-year-old trees that were mounded, the first concentration causing no damage, the second slight and the third moderate damage. Paradichlorobenzene, applied when the mean temperature of the preceding week had been at least 65·2°F. at rates of ½ oz. for the three-year-old trees and 1 oz. for the others and followed by mounding, gave satisfactory control, but was rather less effective than the emulsion; it caused no injury in any of the tests.

It is concluded that applications of ethylene-dichloride emulsion during warm periods in October when the soil is dry give excellent control in Virginia, but that the compound should not be used when the soil is water-logged or frozen or when its temperature is extremely high. It is preferable to pour the liquid on the ground, avoiding the base of the tree, and it is unnecessary to mound the trees, though two shovelfuls of soil put round them after treatment prevent surface loss of the fumigant. The diluted emulsion should be agitated before each tree is treated. Under these conditions, ethylene dichloride did not injure the trees when used at the recommended dosages.

Johnson (J. P.). **Control of the Japanese Beetle.**—*Circ. Conn. agric. Exp. Sta.* no. 157 pp. 29–36, 1 fig. New Haven, Conn., 1943.

A brief account is given of the life-history of *Popillia japonica*, Newm., its distribution in Connecticut, where it is now a major pest in four counties, and its control by natural enemies, including birds and mammals, introduced insect

parasites [*cf. R.A.E.*, A **28** 643], the bacterium, *Bacillus popilliae* [*cf.* **31** 504] and the Nematode, *Neoaplectana glaseri*, Steiner, and by other means. Measures against the adults comprise jarring them from small trees and shrubs, trapping [*cf.* **30** 123] and treatment with sprays [*cf.* **27** 533; **30** 551] or dusts [*cf.* **30** 189]. These should be applied as soon as the beetles appear if infestation is light, or before, usually about the end of June, if it is heavy, and then every few days. Details are given of suitable treatments for flowering plants, vegetable crops, small fruits and grape vines and fruit and other trees. Measures against the larvae in turf include treatment with lead arsenate, applied in water or in dry sand or friable soil [*cf.* **25** 37, etc.], or with carbon-bisulphide emulsion. The effect of lead arsenate, applied to the soil against *P. japonica*, on flowering and vegetable plants is discussed [*cf.* **31** 486].

HAMILTON (C. C.), Ed. **Entoma. A Directory of Insect Pest Control.**—5th edn., 202 pp. New Brunswick, N.J., Eastern Br. Amer. Ass. econ. Ent., 1943. Price $1.00.

The fifth edition of this directory, which has been completely revised, includes, in addition to the information in earlier editions [*cf. R.A.E.*, A **29** 438, etc.] lists of the officials of the United States Department of Agriculture and of American associations, societies and dealers that may be of interest to entomologists and other biologists, with notes on the nature of the organisations.

MCKENZIE (H. L.). **Miscellaneous Diaspid Studies including Notes on *Chrysomphalus* (Homoptera: Coccoidea; Diaspididae).**—*Bull. Dep. agric. Calif.* **32** no. 2 pp. 148–162, 9 figs., 2 refs. Sacramento, Calif., 1943.

The eight new species described include *Lindingaspis magnifica* from tea in Uganda and grape-fruit in Kenya Colony; *L. fusca* from a sago-palm (*Cycas circinalis*) in India; *Hemiberlesia mendax*, which was intercepted in California on orchids from Guatemala; *Lepidosaphes mackieana*, which is recorded in all cases on orchids of the genus *Dendrobium*, from greenhouses in Washington, D.C., New Jersey and California, and intercepted from Hawaii; and *Parlatoria citri* intercepted in California on leaves of *Citrus* from Java. The other species dealt with include *Lindingaspis floridana*, Ferris, which is recorded, for the first time outside the United States, on *Olea* in India. A revised key is given to the ten species of *Chrysomphalus* [*cf. R.A.E.*, A **28** 64], including a new one (*C. variabilis*) described in this paper.

MARTIN (J. P.). **Stem Galls of Sugar-cane induced with Insect Extracts.**—*Science* **96** no. 2480 p. 39. Lancaster, Pa., 1942. [Recd. 1944.]

Following experiments in Hawaii in 1936, in which stem galls on sugar-cane were induced by the inoculation of extracts of *Draeculacephala mollipes*, Say [*cf. R.A.E.*, A **26** 585], galls were produced in 1941 by inoculation of similar extracts of *Peregrinus maidis*, Ashm., and *Trionymus sacchari*, Ckll., and galls developed even when extracts of *P. maidis* and *D. mollipes* were sterilised at 15 lb. steam pressure for 20 minutes, indicating that the stimulus is chemical rather than biological. It is possible that insects carry certain growth-promoting substances, which, when injected into plants during feeding, produce galls. Galls developed in 40–85 per cent. of the stalks injected with sterilised and unsterilised insect extracts; in one series they were seen after 12 days and were well developed in 4–6 weeks. The two definite effects on the cane were that the buds near the point of inoculation became stimulated and produced rapid growth and that stem galls formed on the meristematic tissue of the stalk. Certain abnormally vigorous shoots produced from adventitious buds arising

from artificially produced stem galls are being studied for growth, vigour and chromosome differences from the parent plant with a view to obtaining polyploid plants.

Cawthron Institute, Nelson, New Zealand. Annual Report 1942.—32 pp. Nelson, N.Z. [1943.]

Notes on entomological work in New Zealand in 1942 are given in two consecutive sections of this report (pp. 23–29). Investigations on the biological control of noxious weeds included a further survey of the distribution of the gorse seed weevil, *Apion ulicis*, Forst. [*cf. R.A.E.*, A **31** 525]. It was present in pods of gorse [*Ulex europaeus*] from 15 of 21 localities in which it had been liberated, in both islands, and there is reason to believe that it is established in some of the others. The percentage infestation of the pods in the positive cases ranged from 4 to 86. A more detailed survey showed that the weevil is well established in the Nelson district. *Antholcus varinervis*, Spin., is maintaining itself on piripiri [*Acaena*] under natural conditions near Nelson, but is very slow in becoming established on a scale that would be effective for the control of the weed [*cf.* **29** 334].

A consignment of 194 larvae of *Ephialtes caudatus*, Ratz., a parasite of the larvae of the codling moth [*Cydia pomonella*, L.], was received from Canada in May. The larvae were reared by keeping them first at room temperature and then in a heated glasshouse under summer conditions, but a rather higher percentage of females was obtained from some that were reared after being kept in a cool store until the end of July. From the 592 second-generation larvae, which were exposed to summer temperatures in February, 402 males and 78 females were obtained. Some were liberated in three abandoned orchards and others retained for breeding.

Further evidence was obtained of the successful establishment of *Angitia cerophaga*, Grav., and *Thyraeella* (*Diadromus*) *collaris*, Grav., which parasitise the larvae and pupae, respectively, of *Plutella maculipennis*, Curt. [*cf.* **31** 526] on cruciferous crops. An analysis of material collected from 85 different crops taken at three localities on the North Island in February showed that the combined percentage parasitism averaged 77·8, as compared with only 3·93 four years before. *Pieris rapae*, L., was again kept in check by *Pteromalus puparum*, L.; and *Apanteles glomeratus*, L., has become well established near Nelson [*cf.* **31** 526]. The data indicate that control was more effective where the two parasites occurred together than where *Pteromalus* was present alone.

Experiments showed that the subterranean grass-caterpillar, *Oxycanus cervinatus*, Wlk., can be effectively controlled by broadcasting a bait of Paris green and bran [*cf.* **31** 362]. Serious damage to cocksfoot grass [*Dactylis glomerata*] in Canterbury and Akaroa [*cf.* **31** 526] was found to be due to the larvae of *Glyphipteryx achlyoessa*, Meyr., which bore in the stems; they also occur in other parts of the Dominion. The infestation is heavier in the older grass areas, where it reaches 78 per cent. or more. The extent of the reduction in yield of the seed has not yet been ascertained. The larvae also attack the stems of wheat, which then produces white heads, and several other grasses. The florets of white clover [*Trifolium repens*] in certain districts in both islands were attacked by the larvae of *Coleophora spissicornis*, Haw., which is a serious pest of red clover [*T. pratense*] in Denmark [**26** 155].

Hincks (W. D.). **Nomenclature Notes on Braconidae and Aphidiidae (Hym.).**—*Entomologist* **76** no. 960 pp. 97–104, 23 refs. London, 1943. **Further Nomenclature Notes on Braconidae and Aphidiidae (Hym.).**—*T.c.* no. 966 pp. 221–224, 3 refs.

Among the genera discussed in the first paper is *Bassus*, F. The author agrees with the view that the genotype is *Ichneumon calculator*, F., so that

Bassus replaces *Microdus*, Nees, and *Diplazon*, Nees, must be used for the Ichneumonid genus to which the name *Bassus* has been applied. In the second paper, he confirms the opinion of Muesebeck in a paper already noticed [*R.A.E.*, A **15** 294] that *Bassus*, F., and *Agathis*, Latr., are not generically distinct. As, however, it has since been shown that the date of publication of *Agathis* is earlier than that of *Bassus*, the former name should be employed and not the latter as Muesebeck supposed.

Other genera dealt with in the second paper include *Bracon*, *Rogas* and *Opius*. A recent decision by the International Commission on Zoological Nomenclature to designate *Ichneumon minutator*, F., as the type of *Bracon*, F., has the effect that this genus replaces *Microbracon*, Ashm., and that *Cremnops*, Först., is reinstated. The author points out that the original spelling of *Rogas*, Nees, should be used, and that various designations of genotypes are invalid. He designates *Bracon gasterator*, Jur., which secures the use of the name *Rogas* in its accustomed sense, *Aleiodes*, Wesm. (type *heterogaster*, Wesm.) being congeneric with it. As *Opius*, Wesm., and *Biosteres*, Först., have the same genotype (*Bracon carbonarius*, Nees), *Biosteres* cannot be used for a distinct group of species, and the author further considers that all the species grouped under the latter should be referred to *Opius*.

Nixon (G. E. J.). **New Braconid Parasites of Australian Wood-boring Beetles with Notes on the Subfamily Hecabolinae (Hym., Braconidae).**—*Bull. ent. Res.* **34** pt. 4 pp. 257–267, 21 figs., 3 refs. London, 1943.

The new species described comprise *Doryctes laemosacci* bred from *Laemosaccus* sp., *Heterospilus asion* from *Xylopsocus gibbicollis*, Mackay, and *Monolexis atis* from *Lyctus brunneus*, Steph., all in Queensland, *M. sorus* from *Minthea rugicollis*, Wlk., in plywood in Malaya, and three species without host records, two from India and one, for which a new genus is erected, from Ashanti.

China (W. E.). **A new Genus and Species of Miridae (Bryocorinae) feeding on *Khaya grandifoliola* in the Gold Coast (Hemiptera Heteroptera).**—*Bull. ent. Res.* **34** pt. 4 pp. 287–290, 2 figs. London, 1943.

Descriptions are given of the adults of both sexes of the Capsid, *Boxia khayae*, gen. et sp. n., collected on *Khaya grandifoliola* in the Gold Coast in 1943 in the course of investigations on insect pests of cacao plantations. The new genus is closely allied to *Sahlbergella*.

Kevan (D. K. McE.). **An Account of *Schistocerca flavofasciata* (De Geer 1773) in Trinidad (Orthoptera : Acrididae).**—*Bull. ent. Res.* **34** pt. 4 pp. 291–310, 13 figs., 31 refs. London, 1943.

A detailed account is given of the morphology of all stages and of the life-history of *Schistocerca flavofasciata*, Deg., in Trinidad, where it occasionally feeds on a variety of crops but rarely causes serious damage. Attempts to produce a swarming phase by crowding were unsuccessful, and it is concluded that this species is not likely to become a pest of major importance. Records of other species of *Schistocerca* occurring in Trinidad, including those of the South American locust, *S. paranensis*, Burm., which has reached it only on rare occasions [*cf. R.A.E.*, A **4** 170], are reviewed.

Callan (E. McC.). **Natural Enemies of the Cacao Thrips.**—*Bull. ent. Res.* **34** pt. 4 pp. 313–321, 1 fig., 28 refs. London, 1943.

Records of natural enemies of the cacao thrips, *Selenothrips rubrocinctus*, Giard, are briefly reviewed, and those that attack it in Trinidad are discussed. In

addition to predacious insects and a fungus, probably *Beauveria globulifera*, they include the Eulophid, *Dasyscapus parvipennis*, Gah., introduced from the Gold Coast in 1935 [*cf. R.A.E.*, A **24** 304]. This parasite is now established in Trinidad as well as in Porto Rico [*cf.* **28** 95] and Jamaica [*cf.* **27** 239] ; it was thought to have died out in Jamaica, but was recovered from *S. rubrocinctus* on mango in 1942. In Trinidad, it has been recovered from this thrips at many scattered points since 1941, and also from *Heliothrips haemorrhoidalis*, Bch., and *Hercothrips insularis*, Hood. The predators comprise *Franklinothrips tenuicornis*, Hood, which commonly attacks *S. rubrocinctus* and *Heliothrips haemorrhoidalis* on cacao, but has not been found on other plants, *F. vespiformis*, Crwf., which attacks the same species much more rarely on cacao, and also *Dinurothrips hookeri*, Hood, on other plants in Trinidad and *S. rubrocinctus* on mango in Jamaica, the larvae of Chrysopids, including four species of *Chrysopa* and *Leucochrysa varia*, Schneider, the adults of the Lygaeid, *Ninyas torvus*, Dist., nymphs and adults of the Capsid, *Termatophylidea maculata*, Usinger, and the ant, *Wasmannia auropunctata*, Roger, which occurs wherever cacao is grown in Trinidad, and is usually associated with *Pseudococcus citri*, Risso, and *Toxoptera aurantii*, Boy., but has been observed on a few occasions carrying larvae of the cacao thrips.

Of the predators, the Chrysopids probably give some control wherever *Selenothrips* occurs, the species of *Franklinothrips* are of less importance and the others are negligible. In laboratory tests, individual larvae of *Franklinothrips* destroyed only 1–2 larvae of *Selenothrips* per day, whereas a Chrysopid larva destroyed 71 in five days. Fortnightly counts made from November 1939 to December 1941 on a cacao estate showed that the maximum population of the cacao thrips occurs in November–December, with a secondary maximum in March–April and the minimum in May–July, and that the larval populations of the Chrysopids and *Franklinothrips* follow this very closely. The eggs of the Chrysopids are commonly parasitised in Trinidad by *Ooencyrtus chrysopae*, Crwf., and an undescribed Eulophid of the genus *Horismenus* has been bred from the cocoons.

HUGHES (T. E.). **The Respiration of** *Tyroglyphus farinae*.—*J. exp. Biol.* **20** no. 1 pp. 1–5, 2 figs., 6 refs. London, 1943.

This investigation into the reactions of *Tyroglyphus farinae*, Deg., to varying concentrations of carbon dioxide and oxygen and to the presence of small quantities of hydrocyanic acid, was carried out in order to obtain some insight into the respiratory activities of the mite. As a necessary preliminary, its reactions to humidity were determined. It respires by direct diffusion through the body surface, since no tracheae are present, and, as it infests stored grain, flour and meal and is associated with the micro-organisms of decay, the gaseous conditions under which it lives are likely to differ considerably from those of ordinary air.

The following are the author's conclusions. *T. farinae* is not viable at a relative humidity of less than 65·5 per cent. at 20°C. [68°F.]. The normal respiratory quotient is in the neighbourhood of 0·9, indicating respiration of a carbohydrate base. The oxygen absorption is in part cyanide-sensitive, which suggests the presence of a " cytochrome "–" cytochrome oxidase " mechanism. Anaesthesia can be produced by concentrations of carbon dioxide above 30 per cent. of the atmosphere and by low oxygen concentrations below 1·2 per cent. The external atmosphere over flour is no guide to the internal conditions within the flour, even when both are enclosed. If exposed to pure carbon dioxide for 72 hours, the mites are killed. They will survive 48 but not 72 hours' exposure to atmospheric nitrogen.

Fraenkel (G.) & Blewett (M.). **The basic Food Requirements of several Insects.**—*J. exp. Biol.* **20** no. 1 pp. 28–34, 12 figs., 11 refs. London, 1943.

The following is based on the authors' summary. A method of breeding six species of insects known as widespread pests of flour on a "synthetic" diet consisting of casein, starch or glucose, cholesterol, yeast, salts and water is described, and the relative importance of the constituents, carbohydrates, sterols and yeast, is analysed. Of the insects studied, *Ephestia kuehniella*, Zell., *Sitodrepa panicea*, L., and *Oryzaephilus* (*Silvanus*) *surinamensis*, L., require carbohydrates, but *Tribolium confusum*, Duv., *Lasioderma serricorne*, F., and *Ptinus tectus*, Boield., do not. The presence or absence of carbohydrates is shown to be a determining factor in the natural distribution of the insects on different foods.

Eastham (L. E. S.) & McCully (S. B.). **The Oviposition Responses of *Calandra granaria* Linn.**—*J. exp. Biol.* **20** no. 1 pp. 35–42, 3 figs., 34 refs. London, 1943.

The following is the authors' summary of the experiments described. The oviposition responses of *Calandra granaria*, L., as manifested by the rate of oviposition, total eggs laid, length of life, length of ovipository life and length of preoviposition period, have been investigated under controlled conditions of temperature and saturation deficiency of air, grain having been acclimatised in its water content to the relative humidity of the air. *Calandra* lives for a shorter time under high than under low temperatures but lays eggs at a greater rate, thus compensating for the shorter life. There is evidence for the existence of an optimum saturation deficiency at each temperature for oviposition rate. Weevils are shorter lived at high saturation deficiencies than they are at low. The total number of eggs laid by weevils is smaller at high than at low saturation deficiencies of air. Water content of the food grain contributes to these results in that dry food is conducive to low rate of oviposition, low total egg production and shorter life.

Lees (A. D.). **On the Behaviour of Wireworms of the Genus *Agriotes* Esch. (Coleoptera, Elateridae). I. Reactions to Humidity.**—*J. exp. Biol.* **20** no. 1 pp. 43–53, 1 pl., 6 figs., 30 refs. London, 1943. **II. Reactions to Moisture.**—*T.c.* pp. 54–60, 1 fig., 14 refs.

The following are substantially the author's summaries of these two papers. The general humidity behaviour, the humidity receptors and the orientation mechanisms have been studied in the larvae of *Agriotes*. They avoid dry air, and, when the alternatives are close to saturation, a difference of 7·5 per cent. in relative humidity in the alternative chamber (at 17°C. [62·6°F.]) ensures the avoidance of the lower humidity by nearly every individual, while the reactions are statistically significant with differences as small as 0·5 per cent. At lower ranges of humidity the same differences yield progressively less intense reactions; at low humidities the response is eliminated. The intensity of the reaction is in better accord with the humidity differences when these are expressed as saturation deficiencies instead of relative humidities. This suggests that the reaction is initiated by the evaporation of water and not by receptors that function hygrometrically. The humidity "receptors" lie on the head. Amputation experiments indicate that the relevant sites of evaporation are distributed between the antennae and maxillary and labial palps; the structure of these appendages is compatible with such a function, while sensillae that might have a hygroscopic function are absent. Orientation is achieved by two mechanisms. First, the larvae are more active in dry than in moist air (low hygro-kinesis); secondly, they show a directed response to low humidities

(klino-taxis) displayed as a powerful backward recoil if they cross a steep gradient from moist into dry air. No tropo-tactic component is involved. The failure of the reaction at low humidities is explained by the great activity of the larvae, which interferes with the operation of the klino-tactic mechanism. It is suggested that the kinesis is maintained by a relatively constant rate of water loss from the head appendages, while the klino-taxis is initiated by any sudden increase in the rate of evaporation. The behaviour can readily be correlated with the humidity conditions prevailing in the soil; the need for such a sensitive response is possibly due to the permeability of the cuticle, which renders wireworms peculiarly liable to water loss in unsaturated atmospheres.

Simple methods are described by which wireworms could be offered the choice of two alternative moistures. An account is given of the construction of a burrow. The extension of the burrow system by a single larva falls off with time; it is probable that under natural conditions such a system is semi-permanent. Wireworms migrate rapidly out of dry sand and aggregate in wet sand. This is due solely to the differential effect of moisture on the burrowing activity. Burrowing wireworms do not respond to gravity. The feeding activity of a small population was found to be much greater at low than at high moistures. This is partly the result of the inactivity of the larvae when exposed to high moistures, and their consequent failure to reach the food. The presence of excess moisture, however, also has the effect of inhibiting all muscular activity, and this influences the manipulation of the mouth-parts during feeding and locomotion alike. These results are in good agreement with a number of purely ecological observations on wireworm behaviour.

MASSEE (A. M.). **Notes on some interesting Insects observed in 1942.**—*30th Rep. E. Malling Res. Sta. 1942* pp. 64–68. East Malling, 1943.

The adults of *Rhynchites aequatus*, L., which usually appear on apple in south-eastern England at about the time of petal fall, were present unusually early in one district in 1942 and attacked the buds while they were still in the green-cluster stage; feeding continued during the pink-bud stage, and even the petals of the fully opened flowers were damaged. A derris dust applied at the pink-bud stage in some orchards prevented further injury. *Anthonomus pomorum*, L., was very destructive in apple orchards in 1941 and 1942, and the fact that it was abundant in 1931 and 1932, and before that in 1921 and 1922, suggests that a peak of population is reached approximately every 10 years. Adults of *Piesma capitatum*, Wolff, which usually occurs in grassy situations and is not of economic importance, fed on the leaves of apple in two localities in June. No immature stages were found at the roots of grass. Fruit trees, especially apple and plum, were severely attacked by *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) in the second half of July in many districts in Kent and Essex, though the trees had been sprayed with oil emulsion in the spring. The infestation was due to a general migration of the adult females in June, largely from hedgerows, and favourable weather in June and July. Adults of *Tomaspis sanguinea*, Geoffr., which in addition to feeding on apple foliage and pear fruits [*cf. R.A.E.*, A **30** 325] attack a variety of plants, fed on the fruits and foliage of cherry in one orchard during the third week of June, causing the typical angular brown markings on the upper surface of the leaves and sunken brown areas on the leaf stalks and fruits. In one locality, adults migrated to hops from wild plants and fed on the foliage, but did not appear to injure the plants. A local outbreak of *Phyllocoptes fockeui*, Nal. & Trt., occurred on the leaves of cherries and, to a less extent, on plums and damsons. The mites hibernate under the scales of the buds and resume feeding in the following April.

The potato Aphid, *Macrosiphum solanifolii*, Ashm. (*gei*, auct.) was commoner on strawberry in Kent than the strawberry Aphid, *Capitophorus fragariae*,

Theo., which has become scarce there during the past two seasons. It mainly infests the under surface of the older leaves and the leaf stalks, though never in large numbers ; its importance on strawberries is slight, since it is not a vector of the virus diseases of this plant [*cf.* **30** 323].

The larvae and adults of *Phaedon tumidulus*, Germ., destroyed the foliage of carrots in two villages, and in one instance the beetles subsequently attacked the leaves of celery in an adjoining bed. All the reported outbreaks were due to migration from common watercress (*Nasturtium officinale*) in a neighbouring stream. Potatoes growing under glass near Harpenden were heavily infested by *Tarsonemus* (*Hemitarsonemus*) *latus*, Banks, in May ; this mite resembles the strawberry Tarsonemid [*Tarsonemus pallidus*, Banks] superficially, but the egg, which is briefly described, is quite distinct.

In May, much damage to hops was caused in one district by *Otiorrhynchus singularis*, L. ; the larvae fed on the roots and the adults on the shoots. The infestation was probably due to the fact that the hops were planted in a recently cultivated orchard pasture in which the weevils had been abundant, and it was controlled by dusting with derris and lead arsenate, together with cultivation. A severe outbreak of *Forficula auricularia*, L., which occurred in June in a pole-work hop garden in the Rochester district, was successfully checked by a lead-arsenate spray, though derris dusts and nicotine sprays were ineffective [*cf.* **32** 15].

Lepidoptera observed during the year included *Cidaria truncata*, Hfn., on the leaves of strawberry, *Anthophila pariana*, Clerck, and *Lophopteryx capucina*, L. (*camelina*, L.) on apple, and *Orthosia* (*Taeniocampa*) *opima*, Hb., which caused considerable local damage to the tips of young shoots of loganberry in late May and early June. The larvae of these moths are briefly described.

GOFFART (H.). **Beobachtungen während der Rapsglanzkäferbekämpfungsaktion 1942.** [Observations in the Course of Control Measures against the Rape Beetle in 1942.]—*Kranke Pflanze* **20** pt. 5–6 pp. 39–43, 3 refs. Dresden, 1943.

An account is given of the course of the infestation of rape in Holstein in the spring of 1942 by the rape beetle [*Meligethes aeneus*, F.]. The first adults were observed on 19th April, and there were two main flights in May. Considerable injury was done to the young, unopened buds of the main stems, losses ranging from 20 to 50 per cent. were noted in the tip shoots, and there was a physiological loss amounting to 15 per cent., so that in some fields more than two-thirds of the buds were lost. Dusting with derris was carried out by the same methods as in the previous year [*R.A.E.*, A **30** 541], but was less successful, probably because of the poor quality of the dust.

KAUFMANN (E.). **Massenauftreten einer Kohlwanzenart an Steckrüben.** [The Mass Occurrence of a Species of Cabbage Bug on Swedes.]—*Kranke Pflanze* **20** pt. 5–6 pp. 43–45, 1 fig. Dresden, 1943.

On October 1941, the aerial parts of swedes in part of a field in the Palatinate were completely destroyed by the Pentatomid, *Eurydema festivum*, L., which was stated to have migrated from cereal and mustard crops in an adjoining field. A few examples of *E. oleraceum*, L., were also observed on the swedes. A proprietary derris dust (Kontra-Halticinea) gave satisfactory control, and no bugs could be found 8 days after dusting. In laboratory tests, nicotine sprays were useless, but proprietary dusts of derris, pyrethrum or pyrethrum and derris gave 80–100 per cent. mortality in 6 days.

FRICKHINGER (H. W.). **Die Drehherzmücke und ihre Bekämpfung.** [The Midge causing Deformed Heart and its Control.]—*Kranke Pflanze* **20** pt. 7–8 pp. 65–68, 3 refs. Dresden, 1943.

In Germany, *Contarinia nasturtii*, Kieff., has been known for about 40 years as a pest of cabbage and other crucifers, and J. Noll, R. Roesler & J. Brenner have recently published an extensive paper (*Arb. physiol. angew. Ent. Berl.* **9** pp. 1–44) on its biology and control, based on observations in connection with an outbreak on cauliflower at Zittau, Saxony. The present paper is a review of it. The Cecidomyiid was found to feed on many crucifers other than the cabbage group, and a list of these is given. The infestation of cabbage is characterised by a twisting of the heart leaves of young plants, and the larvae can be seen by pushing these leaves apart so as to free the leaf axis. Oviposition occurs mostly on warm days, and the eggs are laid in masses of 15–20, between the stems of the younger heart leaves. The larvae hatch in 4–5 days at 20°C. [68°F.], or 9 days at lower temperatures, and complete their development in 7–8 days at 20–22°C. [68–71·6°F.], which is the optimum. The deformation of the heart leaves that accompanies infestation is ascribed to growth being checked at the places where the larvae feed, and also probably to the secretion of toxins by them.

Pupation occurs in the ground in a cocoon covered with particles of earth. There are on an average three generations a year, the adults appearing in early June, early July, and early August. The larvae of the third generation and also some of those of the first and second overwinter and pupate in spring. The occurrence of outbreaks is probably due to a combination of high temperature and high humidity at a time when there are many larvae in the soil. Infestation by *C. nasturtii* is often followed by a heart rot that completes the destruction of the plants.

None of the repellents tested against the adults was satisfactory. Nicotine sprays gave the best mortality of the larvae, and it is recommended that if infestation is severe, the fields should be sprayed weekly from June to August. Some mortality was given by the application of calcium cyanamide and kainit to the soil, but increased cultivation had little effect.

MARTELLI (G. M.). **Association between the Larvae of the Diptera** *Ceratitis capitata* **and** *Lonchaea splendida*.—*Int. Bull. Plant Prot.* **16** no. 5 pp. 65M–67M. Rome, 1942. [Recd. 1944.]

Observations on the association between larvae of *Ceratitis capitata*, Wied., and *Lonchaea aurea*, Macq. (*splendida*, Lw.) were made over a period of five years in western Libya [*cf. R.A.E.*, A **28** 54]. The first generations of *C. capitata* develop in the fruits of *Citrus*, apricot, peach, etc., but from July until September, the larvae live in the pods of chillies (*Capsicum*). This is attributed to the absence of more suitable fruits, as chillies are not infested in other Mediterranean regions in which the climatic conditions are similar. The pods are attacked at all stages of development after attaining the size of a hazel nut, and all the varieties of chilli grown in the region are susceptible. The number of larvae per pod varies considerably, partly according to the season ; in summer it ranged from 6 to 153, with an average of about 30, but in late summer and autumn did not exceed 19. Attack by *Lonchaea* follows that by *Ceratitis*. The eggs are deposited in openings made by the Trypetid larvae or in the oviposition punctures of the females, and 39–737 larvae of *L. aurea* were observed in a single pod. Because of the greater number of larvae per pod and their association with one or more symbiotic bacteria, the infestation results in the complete destruction of the pods, whereas *Ceratitis* only partly destroys them. The presence of the symbiotic coccobacillus of *Ceratitis* [**22** 329] is not necessary for *Lonchaea*. In addition to chillies, fruits of *Citrus* and peach attacked by

Ceratitis and potato tubers attacked by *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., are also infested by the Lonchaeid; infestation by it does not always follow attack by other insects, since larvae have been found in pods injured by other agencies, but experiments showed that it cannot attack sound fruit and vegetables.

MASON (F. R.). **Annual Report of the Department of Agriculture and Fisheries (Palestine) for the Year ended March 31, 1942.**—13 pp. Jerusalem, 1943.

This report includes brief notes (pp. 10–12) on work on insect pests in Palestine during the year ending 31st March 1942. The intensity of attack on *Citrus* by the species of *Pseudococcus* known locally as *P. comstocki*, Kuw. [see next abstract] again decreased though the area of infestation increased [*cf. R.A.E.*, A **30** 508], and it was not of economic importance at the end of the year. Mass breeding of *Clausenia purpurea*, Ishii, was continued on a larger scale and over 100,000 adults of this Encyrtid were liberated. Recoveries have been made at considerable distances from the liberation points and in some places parasitism has risen to 90–100 per cent.

Experiments on deciduous fruit trees showed that sprays of 0·7 per cent. zinc arsenate or 0·4 per cent. aluminium arsenate and 0·025 per cent. Agral were as effective against *Cydia* (*Carpocapsa*) *pomonella*, L., as the usual mixture of lead arsenate and Agral. The best results were obtained by spraying with 1 per cent. of a proprietary cryolite (Cryocide) and 1 per cent. summer oil, either for the whole season or in final sprays following lead arsenate, and this treatment avoids arsenical residues. The addition of 0·4 per cent. dicyandiamide increased the efficiency of spot sprays consisting of 0·8 per cent. copper carbonate, 0·8 per cent. zinc sulphate and 4 per cent. sugar against *Ceratitis capitata*, Wied., on stone fruit trees. A mixture of 0·7 pe rcent. zinc arsenate, 0·4 per cent. dicyandiamide and 4 per cent. sugar also gave good results. It is now considered that full control of *Parlatoria oleae*, Colv., on apple requires a pre-winter application of a 5 per cent. winter wash of 6 per cent. tar oil followed by a second application in spring. The percentage mortality from these sprays is 80 in winter and 95 in spring. The percentage of uninjured fruit on pomegranate trees sprayed with 125 gm. sodium fluosilicate, 140 gm. lime, 125 gm. Agral, 25 gm. flour and 400 gm. talc per 4 gals. water for the control of *Virachola livia*, Klug, was 70, as compared with less than 30 on untreated trees. Two applications of a dust of barium fluosilicate and sulphur (30 : 70) following a preliminary dusting with sulphur gave almost as good control of *Polychrosis botrana*, Schiff., on grape vines as the usual mixture containing equal proportions and considerably reduced the cost.

Investigations on the ecology of *Syringopais temperatella*, Led., on cereals showed that aestivating larvae lie chiefly at a depth of 7–8 ins. and are not reached by the Arab plough. There is some evidence that aestivating larvae can remain in diapause for more than one season.

Other insects on which work was done included *Capnodis carbonaria*, Klug, on stone fruit trees, *Anarsia lineatella*, Zell., on peaches, *Eriosoma lanigerum*, Hsm., on the roots of apple trees, *Myiopardalis pardalina*, Big., and *Aulacophora* (*Rhaphidopalpa*) *foveicollis*, Lucas, on melons and cucumbers, and *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., on stored potato tubers.

RIVNAY (E.) & PERZELAN (J.). **Insects associated with *Pseudococcus* spp. (Homoptera) in Palestine, with Notes on their Biology and economic Status.**—*J. ent. Soc. sthn Afr.* **6** pp. 9–28, 6 figs., 5 refs. Pretoria, 1943.

An account is given of investigations carried out since 1938 on the natural enemies of the group of closely allied species of *Pseudococcus* that attack *Citrus* in Palestine, one of which may be *P. comstocki*, Kuw. They are referred to as

the "*comstocki* mealybugs." Monthly inspections of two infested groves in 1939 and 1940 showed that the populations of these mealybugs are greatest during April–May, as a result of favourable temperatures in March and April, and low in August, owing to the hot dry weather in May–July and also to the abundance of natural enemies. Examinations of the insects obtained from fortnightly collections of heavily infested leaves showed that an undetermined Cecidomyiid, *Chrysopa* sp., the Hemerobiid, *Sympherobius amicus*, Nav., and the Coccinellids, *Scymnus suturalis*, Thnb., *S. includens*, Kirsch, *S. fenestratus*, Sahlb., *S. quadrimaculatus*, Hbst., and *Hyperaspis pumila*, Muls., are predacious on the mealybugs [*cf. R.A.E.*, A **29** 339]. The Cecidomyiid larvae attack the eggs and young stages of the *comstocki* mealybugs and also of *P. citri*, Risso, in all parts of the country, but are not sufficiently numerous to be of much value. Many pupae of *Chrysopa* sp. were destroyed by parasites of the genus *Perilampus* and other causes; *Sympherobius* was more numerous, but neither species affords much control. The eggs of *Scymnus suturalis* were usually laid in the egg sacs of the mealybugs or between masses of individuals. The egg, larval and pupal stages lasted from 5–7, 6–8 and 4–6 days at 29°C. [84·2°F.] to 7–9, 9–10 and 9–10 days at 25°C. [77°F.]. The preoviposition period lasted about a week at higher temperatures and no eggs were laid when the temperature fluctuated from 14 to 18°C. [57·2 to 64·4°F.]. The eggs of *S. includens* were also laid in the egg masses, and its egg, larval and pupal stages lasted 6–7, 10–12 and 6–8 days at 27°C. [80·6°F.]. *S. quadrimaculatus* completed its development in four weeks at 29°C. and five weeks at 25°C. An unidentified species of *Scymnus* that was found in large numbers on a twig infested with *P. citri* fed readily on the *comstocki* mealybugs in the laboratory. The eggs of *Hyperaspis pumila* were deposited on fruit, twigs or leaves near mealybug colonies, and the egg, larval and pupal stages lasted 6–9, 8–14 and 9–14 days at 27–28°C. [80·6–82·4°F.]. *S. suturalis* and *S. includens*, of which the former is the commoner, afford considerable control of the mealybugs. The adults are present throughout the year, sheltering during winter and becoming more active with the onset of warm weather. They increase to a maximum abundance in May–June and then decrease, owing to scarcity of food, high temperature or parasitism by an Encyrtid, possibly *Homalotylus quaylei*, Timb., which was reared from the larvae of both species. This parasite was also bred on *S. quadrimaculatus* in the laboratory, where its development lasted about 16 days at 29°C. The percentage parasitism was very low in May, increased to a peak of at least 40 in August–September, and dropped suddenly in November. Adults were taken from May to October.

The parasites of the mealybugs [*cf. loc. cit.*] comprised the Encyrtids, *Leptomastidea abnormis*, Gir., *Leptomastix flavus*, Merc., and a species of *Anagyrus* (diversely identified as *A. pseudococci*, Gir., and *A. kivuensis*, Comp.), which was first recorded from mealybugs in Palestine during the summer of 1938 and is possibly a recent introduction. *Leptomastidea* and *Anagyrus* oviposited freely in *P. citri*, the *comstocki* mealybugs and others, and no differences were observed in the rates of reproduction in the various hosts. The greatest numbers of offspring per female were 57 and 45, respectively. Unfertilised eggs gave rise to males. *Leptomastidea* showed a marked preference for the younger stages, and its development lasted from 17 days at 26°C. [78·8°F.] to 30 at 18°C. Random collections of mealybugs of all stages showed that the percentage parasitism was 1–2 in winter and sometimes reached 6 in summer. *Anagyrus* usually attacked third-stage larvae or females that had not become gravid, and the average developmental period was 16 days at 27°C. and over 60 at 17°C. [62·6°F.]; it is active only in September–November and May–July, and experiments indicated that the thresholds of reproduction and development are 15–17°C. [59–62·6°F.] and 13°C. [55·4°F.], respectively. *Leptomastix* was the commonest of the Encyrtids and parasitised more than 35 per cent. of the adults of the *comstocki* mealybugs at the height of its activity. It did not

reproduce in *P. citri* experimentally. The developmental period was 16–18 days at 23–25°C. [73·4–77°F.], and females frequently produced more than 100 young, though reproduction was negligible at 15–21°C. [69·8°F.]. The parasite is rare and inactive during winter, increasing in June and remaining active until cold weather begins in autumn; the peak of parasitism usually occurs in August. The relative economic importance of the three parasites is discussed, and it is pointed out that *Leptomastix* reproduces more rapidly than the others and is active throughout the summer, and *Leptomastidea* has the advantage of being active in mid-winter, while *Anagyrus* attacks *P. citri* more readily than the *comstocki* mealybugs.

An Encyrtid of the genus *Thysanus* taken in 1938 and 1940 did not reproduce in the presence of large numbers of *comstocki* mealybugs in various stages, but when either a pair of *Leptomastix flavus* or a female of the introduced parasite, *Clausenia* [*purpurea*, Ishii (**31** 440)] was also present, offspring of both species were obtained, indicating that it is a hyperparasite. It apparently attacks mature larvae and pupae most successfully. Its life-cycle is longer than that of most of the native Encyrtids, it is less prolific, and it did not much affect parasitism by them. Other Hymenoptera collected included one that was believed to be a species of *Bothriocraera*, which was abundant only in 1938, and of which the host relations were not ascertained, and a number of parasites of other insects.

Ullyett (G. C.). **Some Aspects of Parasitism in Field Populations of *Plutella maculipennis* Curt.**—*J. ent. Soc. sthn Afr.* **6** pp. 65–80, 10 graphs, 11 refs. Pretoria, 1943.

The results are given of field studies of populations of *Plutella maculipennis*, Curt., and its natural enemies on cabbage carried out in the Transvaal over a period of five years to determine the factors affecting host selection and the distribution of progeny of the parasites. A species of *Angitia* is the dominant parasite, others occurring in small numbers. Dissections of random samples of host larvae collected in the field showed that superparasitism by this species was usually absent at the beginning of the season, but invariably appeared later, when the populations of host and parasite had become thoroughly established in the growing crops. At this time, the percentage parasitism was higher than would be expected from random distribution of progeny, implying a discriminating faculty in the female parasites. This was confirmed by detailed analysis of four samples from consecutive weekly records, which also showed that although the percentage parasitism did not vary significantly between samples and the percentage superparasitism did so, there was a positive relation between the numbers of hosts showing parasitism and superparasitism; that the host population, expressed as the number of larvae per plant, was highest when the plant was young and therefore had the smallest surface area; and, contrary to what might have been expected, that the percentage of hosts in which superparasitism was found varied directly with the numbers of host larvae per plant and the ratio of hosts to female parasites. This apparent anomaly is explained by the increase in the area that the parasites had to search as the plants grew. Also, parasites may migrate to more favourable areas when the host density becomes very low.

In a discussion of additional considerations that may have an important bearing on the general aspects of the modification of discriminative ability by environmental factors, it is pointed out that a parasite can examine hosts that are stationary or very sluggish, such as eggs and pupae, more thoroughly than active larvae and so should be better able to determine whether they have been parasitised previously; that hosts in inaccessible positions, such as inside stems or fruit, or in a protective envelope in the case of pupae, cannot readily be examined, though discrimination appears to be exercised in certain instances;

that paralysis of the host before oviposition gives the greatest opportunity for examination ; and that in cases in which only one individual can be supported by a host, discrimination is limited to determining whether the host has been parasitised previously, whereas if several parasites can reach maturity in one host, the ability to sense the size of the host in relation to the number of progeny it will support is important.

Bracon (*Microbracon*) *hebetor*, Say, sometimes parasitises *Plutella* larvae in the field ; its appearances are sporadic and depend largely on the stage of growth of the plant as well as on the incidence of its more usual hosts. It attacks larvae within restricted spaces between the folded leaves of the heart of the cabbage and paralyses them before oviposition ; the progeny are ectoparasitic and several can develop on each host. In laboratory tests, females of *B. hebetor* were caged for 24 hours at 80°F. with varying numbers of larvae of *Plodia interpunctella*, Hb., on which the development of the parasite is the same as on *Plutella*, after which the numbers of hosts paralysed and the number of eggs deposited on each larva were recorded. The female usually paralysed all the hosts with which it came into contact before beginning to oviposit ; one or two paralysed larvae may be used for food, and oviposition does not occur on these. When only 2–4 hosts were supplied, eggs were laid on all of them, and the numbers of larvae that were paralysed but not parasitised increased with the number provided per female. As the number of paralysed hosts increased from two to ten, the number of eggs per host decreased from 10·7 to 3·5, and when more were available, the number of eggs per host varied much less ; the total number of eggs laid remained approximately constant. Although 8–12 parasites can develop on a single larva of *Plodia*, the adults formed are small and relatively infecund ; 4–6 parasites per host give rise to normal adults. In the field, although the larvae of *Plutella* attacked by the parasite usually occur singly, so that there is no apparent opportunity of gauging the extent of possible host material in relation to the number of eggs that should be laid per host, larvae were found that had been paralysed but not parasitised ; in some cases these had served as a source of food, in others they were in good condition and remained so for some time, and in yet others they soon developed the final stages of disease. Very few larvae were found bearing more than 4–6 parasites, and discriminative ability is therefore apparently exercised in the field.

Multiparasitism is most likely to be caused by *Angitia* and a species of *Apanteles* that is the commonest of the other parasites of *Plutella* and is found nearly all the year round. In such a case, *Angitia* always survives. Analysis of records indicated that parasitism was almost entirely due to *Angitia* over most of the period studied and that an increase in *Apanteles* can occur only through a relative decrease in *Angitia*, though the changes are not necessarily proportional. The presence of other parasites appeared to be correlated with a tendency for *Apanteles* to increase to larger numbers than usual. These conditions are not affected by the degree of total parasitism. The activity of predators of *Plutella* is closely associated with low parasitism and high host density.

THERON (P. P. A.). **Experiments on terminating the Diapause in Larvae of Codling Moth.**—*J. ent. Soc. sthn Afr.* **6** pp. 114–123, 25 refs. Pretoria, 1943.

The long larval diapause of *Cydia* (*Carpocapsa*) *pomonella*, L., during the winter is a serious obstacle to the rearing of pupal parasites of this moth and to other studies for which pupae or adults are required in winter, and preliminary experiments were therefore carried out in June–August 1942 to break the diapause in hibernating larvae that were collected from hessian bands on pear and apple trees in Cape Province during March and April and allowed to spin fresh cocoons in rolls of corrugated paper. Exposure to a temperature of 80°F. throughout the winter, or to 41° and then to 80°, and exposure of larvae that

were soaked in water once a week to 41°, room temperature and 80° for varying periods up to three weeks before storing them at 80° had little or no effect in ending the diapause. Other treatments that failed to terminate it comprised exposing the larvae to various gases, subjecting them to electrical shocks, centrifuging them in their cocoons and irradiating them with gamma rays. On the other hand, removing the larvae from their cocoons, which caused them to spin fresh ones, resulted in pupation within a relatively short time, in some cases after only one or two but usually after three or four had been spun. It was found that the average weight of the pupae remained constant, irrespective of the number of times the larvae had spun cocoons, and it seems that enforced spinning eliminates the factors inhibiting metabolism and further development of hibernating larvae ; this may be due to an increase in the relative water or fat content as a consequence of the loss of proteins in the form of silk or to excretion of the inhibiting or inactivating substances from the silk glands.

HATTINGH (C. C.). **The Distribution of Codling Moth Eggs on Pear Trees.**—*J. ent. Soc. sthn Afr.* **6** pp. 124–130. Pretoria, 1943.

In view of the desirability of knowing the type of surface to which ovicides must be applied for the control of the codling moth [*Cydia pomonella*, L.], investigations were carried out in the summer of 1939-40 in an orchard in Cape Province containing four varieties of pears, to determine which parts of the tree usually receive most eggs, whether these are deposited in the same position throughout the season and their quantitative distribution.

From the data obtained, it is concluded that the proportion of eggs in any situation varies with the season, most being laid on the twigs and branches at blossoming time, when very few leaves are present, most on the leaves of the fruiting points at the time of fruit setting, and increasing numbers on the fruit, slightly fewer on the leaves and still fewer on the twigs and wood as the season advances ; the fruit is most attractive for oviposition just before the normal picking stage and its attractiveness progressively decreases as it matures further. The relative numbers on the lower and upper leaf surfaces vary in different varieties, owing to the different ways in which the leaves curl during the dry part of the summer, and it seems evident that an ovicide should be adapted to adhere equally well to both leaf surfaces and to fruit, twigs and branches.

JOUBERT (C. J.). **The Introduction into the Union of South Africa of some natural Enemies of Mealy Bugs.**—*J. ent. Soc. sthn Afr.* **6** pp. 131–136, 2 refs. Pretoria, 1943.

As a result of studies in California in 1933–34, several parasites of mealybugs that attack fruit trees and vines were introduced into South Africa and liberated there. The methods adopted for rearing, packing and transporting them are described. Of the parasites of *Pseudococcus maritimus*, Ehrh. [*cf. R.A.E.*, A **12** 588], *Chrysoplatycerus splendens*, How., and *Zarhopalus corvinus*, Gir., were released in various localities at intervals from 1934 to 1940, inclusive, and both were recovered from this host, the former in considerable numbers from pear orchards in 1940 and at the beginning of 1942, and the latter in small numbers from an orchard in 1935 and from vines in April 1942. *Pseudaphycus angelicus*, How., oviposited readily in *Pseudococcus maritimus*, but only about 10 per cent. of hosts produced adult parasites ; it was therefore bred in *P. adonidum*, L., and liberated between April 1936 and April 1940 in small numbers on plants infested with this mealybug. *Acerophagus notativentris*, Gir., was also introduced, but could not be reared in the race of *P. maritimus* occurring in South Africa, or, by the author, in the one that infests *Citrus* in southern California [*cf. loc. cit.*]. *Coccophagus gurneyi*, Comp., and *Leptomastidea abnormis*, Gir., which

are parasites of *P. gahani*, Green, and *P. citri*, Risso, respectively, were both liberated on an extensive scale and recovered from their hosts in small numbers. *C. gurneyi* appears to have become established, though its activities have probably been hampered by the presence of large populations of the Argentine ant [*Iridomyrmex humilis*, Mayr].

The two predacious Coccinellids, *Scymnus sordidus*, Horn, and *S. guttulatus*, Lec., were also introduced, and small numbers of each were liberated in 1935.

ANDREWARTHA (H. G.). **The Significance of Grasshoppers in some Aspects of Soil Conservation on South Australia and Western Australia.**—*J. Dep. Agric. S. Aust.* **46** pp. 314–322, 9 figs., 8 refs. Adelaide, 1943. **The Significance of Grasshoppers in Soil Conservation in South Australia and Western Australia.**—*J. Aust. Inst. agric. Sci.* **9** no. 2 pp. 69–71, 5 refs. Sydney, 1943.

In the first of these papers, of which the second is a shorter version, the author points out that the zone in South Australia inhabited by *Austroicetes cruciata*, Sauss., lies between the wheat belt in the south and the pastoral lease country in the north. This area was opened up for wheat more than 50 years ago, but wheat growing has gradually been abandoned and the land used for sheep. The pastures are dominated by species of plants that may produce a luxuriant growth during a good season, but may disappear completely as a result of drought, or even during any summer because of overstocking. This leads to the widespread soil erosion that has already reduced the fertility of large areas. In a dry year, the grasshoppers compete with sheep for food and become an additional factor in soil erosion. The usual control measures against grasshoppers are uneconomic in an area where 8–10 acres are required to maintain one sheep, and it is suggested that a solution of the problem may be found if research is undertaken with the object of establishing pastures dominated by perennial shrubs, such as *Acacia victoriae* and *Atriplex*, which are eaten by sheep but unsuitable as food for grasshoppers. Even under existing conditions, when the grasses and other food-plants of grasshoppers are not in competition with perennials, droughts have caused widespread destruction of the grasshopper population five times in the last 50 years [*R.A.E.*, A **31** 423]. If the pastures were dominated by perennials, this would occur as a result of less severe droughts, and hence more frequently, and grasshopper outbreaks might become rare.

In Western Australia, the grasshopper belt is in a similar climatic zone in which wheat growing has been largely abandoned, but the raising of sheep is only now being undertaken. It is probable that a similar problem will arise if sheep are maintained on the pastures of barley grass and other annuals that have developed on the abandoned wheat fields.

AITKEN (Y.) & GRIEVE (B. J.). **A Mosaic Virus of Subterranean Clover.**—*J. Aust. Inst. agric. Sci.* **9** no. 2 pp. 81–82, 7 refs. Sydney, 1943.

Mosaic symptoms associated with pronounced stunting have for some years been observed in *Trifolium subterraneum* in an experimental pasture field in Victoria, and evidence was obtained in 1941 and 1942 that the disease occurred more widely in the State. It spreads rapidly in infected areas, resulting in a loss of over 50 per cent. of spring growth, and may reduce seed production. Studies begun in 1942 showed that the virus infects several species of clover and other leguminous plants, and is possibly transmitted through the seed. It was transmitted experimentally by expressed juice and by Aphids. The relationships of the virus are briefly discussed.

De Bach (P.). **The Effect of low Storage Temperature on Reproduction in certain parasitic Hymenoptera.**—*Pan-Pacif. Ent.* **19** no. 3 pp. 112–119, 7 refs. San Francisco, Calif., 1943.

In view of the lack of knowledge regarding the effect on insects of cold storage and the divergent results recorded for different parasites, which are discussed, studies were made on the effect of refrigeration on *Mormoniella vitripennis*, Wlk., and *Muscidifurax raptor*, Gir. & Sand., both of which are pupal parasites of *Musca domestica*, L., and produce males if reproduction is parthenogenetic. Mature larvae of *Mormoniella* gave rise to adults in 9 days at 23°C. [73·4°F.] and in 28 days at 15°C. [59°F.], had pupated after 31 days at 10°C. [50°F.], and showed no outward change after 31 days at 6°C. [42·8°F.] or 0–2°C. [32–35·6°F.]. The pupae and larvae were then allowed to complete their development at 27·5°C. [80·6°F.]. Fecundity was found to be highest in adults from the batches kept at 0–2 or 6°C., and lowest in those that emerged at 23 or 15°. The ratio of males to females was somewhat lower in adults from the batches exposed to low temperatures, indicating that the male larvae and pupae may be more susceptible, but the males obtained were apparently not sterilised by the exposure [*cf. R.A.E.*, A **27** 144, etc.], since the sex ratio in the succeeding generation was normal. Adults of *Muscidifurax* obtained after exposure to 4·4°C. [39·92°F.] for 28–31 days as larvae or 25 days as pupae did not differ appreciably from controls either in reproductive capacity or sex ratio of progeny. Adults of both species normally live for 1–2 weeks, but they survived for 1–5 months at 4·4°C., when removed every 3–4 days and allowed to feed on honey; the reproductive processes appeared to be unaffected, but mortality was high after the longer exposures. Adults of *Pachycrepoideus dubius*, Ashm., and *Bracon* (*Microbracon*) sp. kept under similar conditions survived for up to four months. In a discussion of the factors responsible for mortality during cold storage, it is suggested that these include starvation and desiccation.

Though cold storage may in some cases affect fecundity and sex ratio, the shipment of immature and adult parasites by this means may prove the most satisfactory method of importation, especially when slow transport over long distances is necessary. The author considers that it is the best method for the parasites under investigation, and that the published data show that it can be applied to many others.

Friend (R. B.). **Connecticut State Entomologist, Forty-second Report, 1942.**—*Bull. Conn. agric. Exp. Sta.* no. 472 pp. 207–315, 1 pl., 19 figs., refs. New Haven, Conn., 1943.

Work on insect pests and their abundance in Connecticut during the year ending 31st October 1942 is briefly reviewed by R. B. Friend (pp. 207–214). In a report on the enforcement of quarantines, M. P. Zappe & L. A. Devaux (pp. 217–219) review the results of the inspection for the presence of *Popillia japonica*, Newm., and state that 89 towns are now known to be infested [*cf. R.A.E.*, A **31** 504]. J. T. Ashworth (pp. 222–225) gives a survey of work in connection with the control of the gipsy moth [*Lymantria dispar*, L.]. P. Garman, W. T. Brigham, J. C. Schread & G. R. Smith (pp. 231–232), in a brief report on biological control, state that 1,260 tons of dust containing spores of the causal organism [*Bacillus popilliae*] of the milky disease of *P. japonica* were distributed over approximately 700 acres of turf during the year. Many more diseased larvae were present in the experimentally infected plots than in the previous year [*loc. cit.*]. The disease evidently becomes established slowly in Connecticut, though it then destroys many larvae. Infestation of peaches by the oriental fruit moth [*Cydia molesta*, Busck] was light in most localities, and was found to vary inversely with parasitism. Comstock's mealybug [*Pseudococcus comstocki*, Kuw.] was reported from eleven orchards in ten

localities, and occurred on pear in two of them. Populations appear to grow rapidly, but the mealybug decreased in the pear orchard in which it was first recorded, where parasitism, chiefly by *Allotropa convexifrons*, Mues. [*cf.* **31** 308, 504], reached 90 per cent.

Investigations on the control of pests of apple are summarised by Garman and J. F. Townsend (pp. 232–240). An attempt to predict the degree of infestation by the rosy apple aphis [*Anuraphis roseus*, Baker] from the rate of hatching on twigs of susceptible varieties obtained from various localities and kept in the laboratory was unsuccessful, and a more reliable basis is apparently provided by considering the abundance of the Aphid and of its natural enemies during the previous year and the weather during the oviposition period. Cold spells with temperatures of 10°F. and less in November are fatal to the ovipositing females, and the temperature and rainfall in May and June are also critical. The toxicity of dinitro compounds to the Aphid and of oil to eggs of the European red mite [*Paratetranychus pilosus*, C. & F.] was not increased in sprays including both. Sprays prepared by dissolving 1 lb. 3,5-dinitro-ortho-cresol or 2,4-dinitro-phenol in 1 U.S. quart waterglass [sodium silicate] diluted with hot water and adding ½ U.S. pint oleic acid before making up to 100 U.S. gals. gave good coverage and control of the Aphid when applied on 2nd April. Lauryl thiocyanate applied at the green-tip stage (17th April) at a concentration of 1 pint in 100 gals. for medium-sized trees and 1½ pints in 100 gals. for large ones substantially reduced Aphid injury to the fruits. Sprays of powdered dinitro-cresol, dinitro-phenol and dinitro-o-cyclohexylphenol in water proved only slightly toxic to the winter eggs of *P. pilosus* in field tests in 1940, and large proportions of the chemicals remained in suspension. Sprays prepared by dissolving the dinitro compounds in monoethanolamine and then adding an equal volume of oleic acid were effective both in 1940 and 1942, and all three compounds killed 97–98 per cent. of the winter eggs in laboratory tests at a dilution of about 0·1 per cent. In experiments in summer, the proprietary rotenone sprays used in 1941 [**31** 505] showed no deterioration due to storage, and very promising results were given by a material (DN–111) stated to consist of 18·45 per cent. of a dicyclohexylamine salt of dinitro-cyclohexylphenol and 81·59 per cent. gypsum, used at concentrations of 12–24 oz. per 100 U.S. gals. The mite was again considerably more abundant in plots that received sprays containing sulphur than in those on which this material was not used; the addition of glue or soy-bean flour to sulphur sprays did not significantly affect the populations.

In investigations of adhesives and reduced spray schedules [*cf.* **31** 483, 505], sprays of lead arsenate and sulphur with lime and silica solution (colloidal silica with a small amount of sodium carbonate), with lime and talc or with aluminium acetoformate, manganese borate and benzoic acid all gave high percentages of uninjured fruit in small-scale trials; the silica spray caused most russetting. The fruits of trees in an orchard that had received rotenone dusts since 1939 and was given five applications of a dust containing 0·5 per cent. rotenone in 1942 were fairly free from infestation by the apple maggot [*Rhagoletis pomonella*, Walsh], although no lead arsenate was applied after the calyx spray of 16th May. In laboratory tests, a dust of tetramethyl thiuram monosulphide was found to be toxic to the adults.

An account by Townsend (pp. 241–248) is given of investigations since 1939 on the biology of *Eulia* (*Argyrotaenia*) *velutinana*, Wlk., on apple, and all stages are briefly described. Orchard and laboratory studies showed that it has two generations a year; larvae of the first occur from petal fall to mid-July or early August, and those of the second from late July or early August until harvest or later. The winter is passed in the pupal stage. The larvae shelter under webs and feed on the lower surface of the leaves and on the surface of the fruit, generally where it is in contact with a leaf or another fruit. Feeding on the fruits sometimes continues after they are stored; wounds due to late

feeding do not heal and provide a means of entry for rots. Insecticides should be applied early in the season, before the larvae are protected by webs. Infestation seemed most persistent on trees with many clusters of small fruits and on trees with succulent foliage. It was very heavy on a block of large, old trees in the autumn of 1939, but in the spring of 1940 no moths were observed and relatively few egg masses were found, possibly owing to the roughness of the bark. After a few weeks the larvae disappeared almost completely, and this is attributed to the poor condition of the foliage caused by *Paratetranychus pilosus* and to very thorough spraying. Egg masses were plentiful on a small block of healthy trees in 1941 and 1942, but infestation had decreased by the summer of 1942. In general, few adults and pupae and very few summer egg masses were found. *Trichogramma pretiosum*, Riley, was reared from about 5·5 per cent. of the egg masses collected in the spring of 1941. Indications of larval parasitism were obtained during the year, and the decrease in populations noted during the investigations is attributed largely to some natural factor or factors.

The results of studies on the seasonal development of eggs and larvae of *Pyrausta nubilalis*, Hb., on maize in 1934–40 are reported by A. M. Vance (pp. 248–266). There are two generations a year over most of the State, but in some parts a small proportion of the population may pass through only one, and indication of a partial third was obtained in 1937. K. D. Arbuthnot found that the multiple-generation strain from one county is capable under laboratory conditions of producing successive generations without the intervention of diapause. The normal winter mortality in this strain in southern Connecticut is rarely less than 5 or more than 10 per cent. During 1934–36, 74·2 per cent. of the eggs in marked egg masses in the field hatched normally ; about 4·5 per cent. were parasitised by *Trichogramma* sp., and 2·7 per cent. were destroyed by predators. In 1935, the proportion of the total mortality occurring in the egg stage was estimated to be 27·9 and 38·9 per cent. for the first and second generations, respectively. The percentages of larvae surviving in early sweet maize averaged 29·5 for the first generation over a period of seven years and 21·7 for the second over four years. The relationship between egg and larval populations is close and direct, regardless of survival rates. Survival of larvae from the eggs was reduced from 37·7 to 19·9 per cent. as the average number of eggs per plant increased from 17·5 to 134. At higher average egg populations, the reduction in survival decreased more gradually, and the percentage never fell below 15. Although weather conditions, notably moisture, probably constitute the principal factor influencing populations, no satisfactory explanation of its operation is available, except in extreme seasons. Low populations in 1941 were attributed to warm, dry spring weather followed by cool rains that destroyed the early emerging moths. A very heavy infestation by first-generation larvae in 1939 is attributed to abnormally moist conditions in March and April followed by warm, dry conditions in May and June.

R. L. Beard (pp. 266–268) reports further investigations on the control of the squash vine borer [*Melittia satyriniformis*, Hb.] by early planting and by a dust containing 1 per cent. rotenone, which confirmed previous results [**31** 506].

The relation between the number of insects on a plant and the amount of damage caused by them is discussed by N. Turner (pp. 268–272) with reference to studies on the control of the Mexican bean beetle [*Epilachna varivestis*, Muls.], some of the results of which have already been noticed [**31** 490]. The treatments compared comprised derris and pyrethrum dusts at five concentrations and the former at six rates of application. The effects of differences in treatment were much less marked when assessed as damage to the plants than as insect mortality. The numbers of larvae surviving on 40 plants three days after the last application of each treatment and the percentages of foliage and pods damaged by them are given in tables and plotted on logarithmic probability grids. Damage on the untreated plants was much greater than would be expected from a consideration of the relation between the number of larvae

and damage on treated plants. It is pointed out that larvae that survived two applications of dust might not cause as much damage as an equal number that were not treated. This may explain the fact that curves obtained by plotting dosage against insect damage are flatter than those obtained by plotting it against insect mortality ; the author considers that either method should be acceptable, though damage to plants is probably of greater practical importance, and points out that these results cannot be regarded as indicative of the amount of damage that would be caused by untreated larvae, since damage is influenced by the protective residues on the foliage as well as by the number of larvae killed. He also discusses (pp. 272–277) the results of these experiments and of others, some of which have been noticed [**31** 490, 509], with regard to the influence of the concentration of the active ingredient of an insecticide on control. He gives dosage-response curves for dusts containing 0·5–8·0 per cent. calomel [mercurous chloride] applied to a small number of cabbage plants as a protection against the cabbage maggot [*Hylemyia brassicae*, Bch.], all of which gave substantially higher yields, and for dusts of derris (0·0625–1·0 per cent. rotenone) and impregnated pyrethrum (0·025–0·4 per cent. pyrethrins) applied at the rate of 70 lb. per acre on 28th May and 16th and 26th June against first-generation larvae of *E. varivestis* on beans, which showed no difference in yield that could be attributed to treatment. The results of these two tests, the preceding one against *E. varivestis* and one against *Pyrausta nubilalis* on maize [**31** 509] are summarised in a table showing the control given in each case by an arbitrarily selected standard concentration and by half that concentration, together with the difference between them expressed in probits. The figures for percentage control by the stated dosage and (in brackets) by half this dosage are : 78 (72) for 4 per cent. calomel dust against *H. brassicae* ; from 87·5 (74) to 99·4 (98) for dusts containing 0·5 per cent. rotenone when the derris was used with different carriers and 96 (90) for a pyrethrum dust containing 0·3 per cent. pyrethrins against *E. varivestis* ; and 54 (35) for 4 per cent. fixed nicotine and 51 (37) for 1 per cent. rotenone [as derris] against *P. nubilalis*. Although the differences between the percentages of control from the two dosages vary considerably, the probit difference is relatively constant, its value in percentage depending on the degree of control afforded by the higher dosage. On the whole, the results indicate that dosages can be considerably reduced if the insecticides give a high degree of control or show a very flat dosage-response curve.

J. P. Johnson (pp. 277–278) records an instance of unusually early appearance of adults of *Popillia japonica*, which is attributed to their having developed in soil warmed by underground steam pipes. *Anomala orientalis*, Waterh., was reported for the first time from two additional towns, and the larvae destroyed many pea, bean and squash plants in the field in which potatoes were attacked in 1941 [**31** 506]. The field was ploughed and harrowed on 6th and 7th June, when most of them had reached the prepupal or pupal stage, and many were destroyed by birds.

In view of the serious position in south-western Connecticut with regard to Dutch elm disease, caused by the fungus, *Ceratostomella ulmi*, Friend (pp. 278–285) reviews the history and present status of the outbreak, describes the symptoms of the disease and gives an account of the way in which it is transmitted by *Scolytus multistriatus*, Marsh., and *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., and of the measures recommended to prevent its spread. P. P. Wallace (pp. 287–290) describes further experiments with chemicals to prevent the breeding of these bark-beetles in elm logs [*cf.* **30** 552]. Felled trees and piles of recently-felled logs of elm or mixed timber of which about 10 per cent. comprised elm in a plot containing many overwintering adults of *H. rufipes* and near a light infestation of *S. multistriatus* were sprayed with a solution of orthodichlorobenzene in fuel oil (1 : 4). There was no attack on the surfaces to which the spray was applied, but it rendered neighbouring unsprayed logs

unattractive for only a week ; a month after treatment, there was no significant difference in the degree of attack on the inner logs of sprayed and unsprayed piles. Treating part of a log rendered the rest of it unattractive for only a day or two. It is unnecessary to spray the upper quadrant of logs in sunlight, since breeding rarely takes place in this region. Excellent control was given by spraying the upper half of logs 12 ins. in diameter and rolling them over after a few minutes ; logs so treated were attacked only by a few adults of *Xyleborus* (*Anisandrus*) *sayi*, Hopk., and *Xyloterinus politus*, Say. Of the trunks of three elm trees felled in June 1941 in an area where infestation by *S. multistriatus* was severe, two were sprayed immediately with light creosote oil or a proprietary preparation (Permasan) containing pentachlorphenol in oil, and the third was left for a month until it was heavily infested, when one end was sprayed with creosote and the other with pentachlorphenol, the middle section being left untreated. When the logs were examined in October, it was found that all the insects under the bark and in the outer sapwood of the logs treated with pentachlorphenol were killed ; there was no attack by bark-beetles after the spray was applied, though infestation by Cerambycids and Buprestids developed. No living insects were found beneath bark sprayed with creosote, and no infestation developed after its application. The effectiveness of all the chemicals tested appeared to be increased at high temperatures. Wallace (pp. 290–291) also records that during the winter of 1939–40, all dead and dying elm wood in a park in which *S. multistriatus* was abundant and crotch feeding had been general and all elm material in which it was breeding or might breed within a radius of $\frac{1}{4}$ mile were destroyed, and in May 1940, five elm logs that were heavily infested with larvae of the beetle were placed 100 yards west of the park, since the prevailing wind came from that direction. In the autumn, a count of the emergence holes showed that 2,025 adults had emerged, but no evidence of feeding was found in over 10,000 elm twig crotches taken at distances of 301–675 ft. from the logs. A year later there was still no evidence of feeding and no material suitable for breeding was present in the area. Earlier observations had indicated that attack on twig crotches is very severe close to the emergence site and becomes negligible at the limit of beetle flight ; the usual limit of flight is extended up to several miles when very large populations occur. The present observations show that under normal conditions of abundance, feeding is eliminated in a small area in the absence of breeding material, and a control zone of 100–200 yards probably affords considerable protection [*cf.* also **32** 47].

Wallace & Beard (pp. 291–305) describe experiments to ascertain the effect of low temperatures on the mortality of larvae of *S. multistriatus*. The following is largely their summary. Bark insulates the larvae against the very rapid momentary changes characteristic of air temperatures, and subcortical temperatures follow gradual changes in air temperatures with a lag of up to several hours, but the insulating effect of the bark does not prevent the subcortical temperature from reaching the extremes of the air temperature. The larvae are not always killed by the freezing of their body-fluids on reaching the undercooling point, and the rate at which the temperature falls does not appear to affect the freezing point. The insulating effect of the bark is of negligible importance in reducing mortality from cold ; small larvae and those with food in the alimentary tract are particularly susceptible. The mortality caused by cyclic temperature changes varying from −2 to −18°F. and occurring three or four times every 24 hours was no greater than that from a single exposure to a temperature of −18°F. No minimum temperature was found at which all larvae died when momentarily exposed ; two momentarily exposed to −62°F. pupated and developed normally and one was alive and active seven days after exposure to −70°F. The relations between degree of cold or length of exposure and mortality can be expressed graphically as a straight line on the log-probit scale. The effect of intensity of cold was not discernible above −5°F. and was

significant below −10°F. Temperatures in Connecticut are seldom such as to cause an appreciable mortality of the larvae or limit the distribution of the beetle.

A section comprising short notes on miscellaneous insect pests by various authors (pp. 305–310) includes records by B. H. Walden of immature stages of *Asterolecanium arabidis*, Sign., occurring in depressions in the distorted stems of perennial *Phlox* in June and of adults on the same plant in August. The young Coccids emerged towards the end of August, and probably overwinter on the roots. Stems of lilac girdled by *Vespa crabro*, L., were received in September ; this hornet seldom attacks cultivated plants, and does so to obtain fibre for its nests. Johnson reports that the continuous area of turf infested by *Nephelodes emmedonia* var. *violans*, Gn., had not increased since 1941 [**31** 508], but isolated infestations occurred at two other places. Populations were smaller than in the previous year, and most of the larvae collected towards the end of the season were infected by a wilt disease ; little evidence of feeding was noticeable by autumn. On 30th September, larvae of *Aphonus castaneus*, Melsh., were collected from part of a golf course where turf was severely damaged and a population of 83 per sq. ft. was reported. On 9th October, larval populations averaged 21·6 per sq. ft., and an area of about 5 acres was generally infested, with isolated infestations elsewhere. Damage was then more noticeable, and there was widespread evidence of the destruction of the larvae by skunks. Four other infestations covering an area of 12 acres were later reported from other parts of the State, one on a golf course where turf was damaged. On 24th October, most of the larvae were within an inch of the surface of the soil, but by the first week in November they were 2–4 ins. below it. Of 22 larvae found in an area of less than 36 sq. ins. in October, six were infested by a muscardine fungus. *Calomycterus setarius*, Roel., was less abundant than in 1941, but was reported from two more towns and is now present in 14. Plants attacked by the adults included clovers, spinach beet, maize and potatoes. In a building where the weevils were troublesome, powdered borax spread on the window-sills caused some mortality. Wallace describes an investigation of the mortality of larvae of *Rhyacionia buoliana*, Schiff., on red pine [*Pinus resinosa*] during the winter of 1941–42, when temperatures as low as −15°F. commonly occurred during January and there was little snow cover. Before 11th January, mortality was normal (10–50 per cent.), but after the extreme cold it was complete in some localities and very high in others.

Smith (W. W.). **Strawberry Insects and their Control in Missouri.**—*Bull. Mo. agric. Exp. Sta.* no. 463, 22 pp., 13 figs., 10 refs. Columbia, Mo., 1943.

Brief notes are given on the bionomics and control of upwards of 20 species or groups of insects that attack strawberry in Missouri, and the results of experiments against *Ancylis comptana*, Froel. (*fragariae*, Walsh & Ril.) in 1939–42 are included. They showed that it is controlled fairly satisfactorily by dusts of cryolite and talc (1 : 3), derris (5 per cent. rotenone) and pyrophyllite or cheap flour (1 : 4), Pyrocide dust (0·2 per cent. pyrethrins) and lead arsenate and hydrated lime (1 : 2), in order of decreasing effectiveness. Dusts gave better control than sprays, of which the most satisfactory were 3 lb. cryolite with a spreading and sticking agent, or 3 lb. lead arsenate or 1 U.S. pint nicotine sulphate, both with ½ U.S. gal. summer oil, per 100 U.S. gals. Three applications of dusts or sprays are required, the first as soon as the flowers open, before the leaves are rolled together by the larvae, and the others at intervals of 5–7 days. They should be repeated if rain washes the deposits from the leaves. There is little risk of poisonous or unsightly residues on the fruit, but in dry seasons, when it may begin to ripen early, the spray of nicotine sulphate should be used for the third application. If serious damage is caused in May, a spray

of cryolite or lead arsenate and oil should be applied against the second generation after harvest.

FREDRICK (J. M.). **Some preliminary Investigations of the Green Scale, *Coccus viridis* (Green), in south Florida.**—*Florida Ent.* **26** nos. 1–2 pp. 12–15, 25–29, 2 refs. Gainesville, Fla., 1943.

The green scale, *Coccus viridis*, Green, was first observed on *Citrus* in south Florida in May 1942, but had probably been present for several years. It seems to be limited to the extreme lower east coast and has been found on 72 species of plants. The groundsel tree, *Baccharis halimifolia*, is a preferred food-plant and may be killed by severe infestations, but *Citrus* is not particularly favoured, although small numbers of young trees were heavily infested. Injury due to the purple scale [*Lepidosaphes beckii*, Newm.] and the long scale [*L. gloveri*, Pack.], which are thought to increase because of the presence of sooty mould on the honey-dew produced by *C. viridis* and which shelter under the bodies of green scales that have been killed by the fungus, *Cephalosporium lecanii*, may be more important than that caused by the green scale itself.

Coccus viridis is parthenogenetic and oviparous; the eggs are laid singly and hatch under the parent scale in periods that vary from a few minutes to several hours. Individual females completed oviposition in 8–42 days, and laid 85 eggs or more during September, October and November. The average life-cycle was about 60 days during the late summer months. The scales readily migrated in search of fresh foliage. Five species of ants attended them, and many species of Diptera and Hymenoptera were observed on infested foliage, apparently in search of honey-dew. Natural enemies included *Chilocorus stigma*, Say (*bivulnerus*, Muls.), two other Coccinellids, a predacious thrips, several species of insect parasites, and the fungi, *Aschersonia cubensis*, *Nectria diploa*, and a species of *Fusarium*, but the only ones of any importance were *Cephalosporium lecanii* and, more locally, an unidentified fungus. In an unsprayed plot of *Citrus*, only 2·8 per cent. of the scales examined on 29th June were dead and *C. lecanii* was not found; on 18th August, 61·2 per cent. were dead and 68·3 per cent. of the dead ones showed mycelia of *C. lecanii*; and in October, when the fungus was more generally distributed over the trees, total mortality had increased to 73 per cent., and 55 per cent. of all the scales examined showed mycelia. The fungus is seldom found associated with the green scale on *Baccharis*, and all attempts to inoculate healthy scales with it failed.

In experiments on infested *Citrus* and *Baccharis*, sprays containing 1·5 per cent. actual oil gave an average mortality of 91·2 per cent., and the degree of control given by 1·6 and 1·7 per cent. oil was not sufficiently higher to warrant their use. Concentrations of 1, 1·12 and 1·33 per cent. oil were effective against the immature stages, but not against gravid adults. A second application of 1 per cent. oil, 6–42 days after the first, increased the average percentage mortality from 85·4 to 96·7, and an application of 1 per cent. oil, 10 days after one of 1·5 per cent., increased it from 70 to 98. Results will probably be most satisfactory if the second spray is applied 4–5 weeks after the first, when all females surviving the first application have completed oviposition. None of the sprays injured the *Citrus* trees, but the second application should be made only in cases of emergency. Since the scales may leave *Baccharis* to infest adjacent *Citrus*, destruction of the former near *Citrus* groves, and particularly young plantings, is advisable.

SCHAFFNER jr. (J. V.). **Sawflies injurious to Conifers in the northeastern States.**—*J. For.* **41** no. 8 pp. 580–588, 3 figs., 13 refs. Washington, D.C., 1943.

The author gives a general account of the habits of the sawflies that have been abundant, at least locally for one or more years, on conifers in the north-eastern United States during the last ten years and of factors that influence their

numbers. Those that hibernate in the egg stage comprise *Neodiprion abietis*, Harr., which prefers balsam fir [*Abies balsamea*] but will attack spruce ; and *N. dyari*, Rohw., *N. banksianae*, Rohw., *N. sertifer*, Geoffr., and an undescribed species of *Neodiprion*, all of which attack pines. Those that overwinter in the cocoon are *Pristiphora erichsoni*, Htg., which sometimes causes heavy mortality of larch [*Larix*], particularly when associated with *Dendroctonus simplex*, Lec. ; *Pikonema alaskensis*, Rohw., and *Gilpinia* (*Diprion*) *hercyniae*, Htg., which feed on spruces ; *G.* (*D.*) *frutetorum*, F., *Diprion similis*, Htg., *N. pinetum*, Nort., *N. pini-rigidae*, Nort., and *Acantholyda erythrocephala*, L., which attack pines ; and *N. lecontei*, Fitch, which is a serious pest of pines and is occasionally found on some other conifers. *Pristiphora erichsoni*, *Pikonema alaskensis*, *Acantholyda erythrocephala* and all the species that hibernate in the egg stage have only one generation a year ; the others have one or more. *N. americanus*, Leach, a species closely allied to *N. dyari*, is apparently unimportant in the north-eastern States, but has defoliated loblolly pine [*Pinus taeda*] severely in Virginia in recent years. Some of these sawflies, six of which have been introduced from Europe, have increased in importance in recent years and caused considerable damage in some localities, particularly in young plantations of pine and spruce. A key is given to the last-instar larvae of the 14 species, with brief notes on the injury caused by each, and records of the food-plants attacked or preferred by it. Preventive and control measures recommended comprise proper silvicultural practices and thorough spraying as soon as the larvae are found, with a mixture of 4 lb. powdered lead arsenate and 4 oz. fish oil per 100 U.S. gals. water applied with a power sprayer, or if the trees are small, with a concentrated spray containing 10 per cent. lead arsenate and 3 per cent. adhesive oil applied by hand equipment as a fine mist.

Evenden (J. C.), Bedard (W. D.) & Struble (G. R.). **The Mountain Pine Beetle, an important Enemy of western Pines.**—*Circ. U.S. Dep. Agric.* no. 664, 25 pp., 20 figs., 4 refs. Washington, D.C., 1943.

An account is given of the bionomics, economic importance and control of *Dendroctonus monticolae*, Hopk., which infests many species of pines in the western United States ; all its stages are very briefly described and its distribution is shown on a map. The annual loss of timber is estimated at over a million dollars. Western white pine (*Pinus monticola*) is attacked in preference to other species in northern Idaho and western Montana, and sugar pine (*P. lambertiana*) in California. Infestation normally occurs in old or weakened trees, windfalls and rejected logs, but healthy trees, both young and mature, are killed during outbreaks. Mature trees of *P. lambertiana* are killed by a progressive attack that involves two or three successive generations and gradually spreads from the top to the base, which is by that time usually infested by *D. valens*, Lec. Young and middle-aged trees and lodgepole pines (*P. contorta latifolia*) are attacked at the base. The female bores under the bark, making an upward gallery 3–24 ins. long following the grain of the wood. The males follow the females, clearing the frass and resin from the entrance hole, where the resin dries and forms a tube. Pairing occurs when the flow of resin has ceased, generally when one or two inches of gallery have been made. The eggs are deposited singly along the side of the gallery and the larvae tunnel at about right angles to it and pupate in cells between the bark and the wood or within the inner bark. The adults do not leave the trees for several weeks after emergence. They apparently fly or are carried by air currents for considerable distances, since infestations have been initiated across timberless areas 15–20 miles wide. Some beetles oviposit in more than one tree, and up to three such attacks may be made if the season is unusually long. The occurrence of this habit varied with the food-plant ; only 10–30 per cent. of the females emerge from *P. lambertiana* after completing their first egg galleries, while nearly all

do so from *P. monticola*. In northern Idaho, western Montana and Washington [*R.A.E.*, A **23** 50], there are one complete generation and a partial second in the year. In eastern Montana and central Idaho, there is only one generation, and development may last two years at very high elevations. In southern Oregon and California, there are two generations and sometimes a partial third.

The most important natural enemies of the beetle are the Braconid, *Coeloides dendroctoni*, Cushm. [**24** 184] and the Pteromalids, *Cecidostiba dendroctoni*, Ashm., and *Roptrocerus* (*Pachyceras*) *eccoptogastri*, Ratz., which are ectoparasites of the larvae; *Lonchaea viridana*, Mg., and the Dolichopodid, *Medetera aldrichi*, Wheeler, the larvae of which are predacious on all stages beneath the bark; and the Clerids, *Enoclerus sphegeus*, F., and *Thanasimus dubius*, F., and the Trogositid, *Temnochila virescens* var. *chlorodia*, Mannh., the adults of which destroy the beetles as they leave or attack the tree, while the larvae feed on all the developmental stages.

In a discussion of direct control measures, it is pointed out that the death of successfully attacked trees cannot be prevented, but that the broods beneath the bark can be destroyed and the spread of infestation hindered. The methods discussed are removing the bark from the logs and leaving the immature stages to be destroyed by predators, which is effective for thin-barked trees, removing the bark and larger branches of large thick-barked trees and burning them, piling up the logs and burning them, spraying logs or the stems of standing trees with fuel oil, which is then ignited, or with a penetrating spray [*cf.* **32** 47] of Diesel oil and orthodichlorobenzene (4 : 1), and exposure of logs to the sun [**18** 642]. Lodgepole pines can be protected from attack by surrounding the lower 15–20 ft. of the trunk with wire gauze (16 mesh).

MacAloney (H. J.). **The White-pine Weevil.**—*Circ. U.S. Dep. Agric.* no. 221 (revd.) 31 pp., 15 figs., 23 refs. Washington, D.C., 1943.

This is a revision of a previous circular [*R.A.E.*, A **20** 439] and in addition to the earlier information [*cf.* **18** 469, etc.], contains an account of experiments [**31** 344] on the control of *Pissodes strobi*, Peck, on *Pinus strobus* in the north-eastern United States by means of concentrated sprays of lead arsenate. Of recent years, this weevil has become an important pest of jack pine [*P. banksiana*] in the Lake States, on which it often oviposits in leaders of the current season.

Dean (G. A.) & Cotton (R. T.). **Fumigation with Methyl Bromide.**—Insert for *Circ. U.S. Dep. Agric.* no. 390, 5 pp. [Washington, D.C.] 1943.

This circular, which is intended as an insert for the revised edition [*R.A.E.*, A **26** 118] of one already noticed [**25** 15], contains instructions for the fumigation with methyl bromide of flour mills and of bagged flour and other milled cereals in warehouses, in atmospheric and vacuum vaults, under tarpaulins, or in railway box-cars, together with information on the properties of methyl bromide and the precautions that should be observed during its use.

Blanchard (E. E.). **Descripción de un nuevo Afidiino argentino, útil para la agricultura.** [Description of a new Argentine Aphidiine beneficial to Agriculture.]—*Rev. chil. Hist. nat.* **44** pp. 45–48, 5 figs. Santiago, Chile, 1940. [Recd. 1944.]

Descriptions are given of the adults of both sexes of *Diaeretus plesiorapae*, sp. n., which was bred from *Brevicoryne brassicae*, L., on cabbage, and *Toxoptera graminum*, Rond., on cereals in both Argentina and Uruguay.

Bridwell (J. C.). **Two new American Bean Bruchids (Coleoptera).**—*Rev. chil. Hist. nat.* **44** pp. 249–258. Santiago, Chile, 1940. [Recd. 1944.]

The author points out that the beans, *Phaseolus vulgaris*, *P. lunatus*, *P. coccineus* and *P. acutifolius*, are of American origin, and briefly reviews the names that have been applied to the only two species of Bruchids hitherto known to infest them. These are *Spermophagus* (*Zabrotes*) *subfasciatus*, Boh., of which *S.* (*Z.*) *pectoralis*, Sharp, is a synonym, and *Bruchus* (*Acanthoscelides*) *obtectus*, Say, which has erroneously been considered by some to be identical with *B.* (*A.*) *obsoletus*, Say. *B. obsoletus* infests the seeds of species of *Tephrosia* (*Cracca*) in the eastern United States and has not been found elsewhere or infesting the seeds of other plants. Two other species that have been in the collection of the U.S. National Museum for several years are here described as *B.* (*A.*) *obreptus*, sp. n., from lima bean (*P. lunatus*) in Mexico, Guatemala, Panama, Trinidad, Venezuela, Colombia, Peru and Chile, and *B.* (*A.*) *obvelatus*, sp. n., from seeds of several varieties of *P. vulgaris* from Mexico. A key is given to *B. obtectus* and the two new species; they are considered to form a closely allied group, the characters of which are described.

Olalquiaga Fauré (G.). **El bruco del frejol en el valle de Limache, Chile.** [The Bean Bruchid in the Limache Valley, Chile.]—*Bol. Dep. Sanid. veg.* **2** no. 1 pp. 25–53, 9 figs., 26 refs. Santiago, Chile, 1942.

Beans (*Phaseolus* spp.) are extensively grown in and around the Limache valley in the province of Valparaiso. Since about 1930, the seeds have been attacked in the field and in store by *Bruchus* (*Acanthoscelides*) *obtectus*, Say, which has also been observed there infesting cowpea, *Vigna unguiculata* (*sinensis*). All the foci of infestation on beans recorded since 1938 have occurred in the municipality of Limache, which is enclosed almost completely by mountains and, since January 1939, the cultivation of plants considered liable to infestation has been prohibited in this zone, in an attempt to exterminate the Bruchid. To ascertain the effectiveness of this measure, the author employed trap cages and trap crops of *P. vulgaris* at various points inside and outside the infested zone. The cages were covered boxes with sides of wire netting that kept out birds and rodents, but offered no obstacle to the Bruchids, and contained 500–1,000 uninfested seeds of *P. vulgaris* on a layer of sand or sawdust, which served as a thermic insulator and counteracted excessive moisture. The trap-crops were enclosed in wire netting. It was shown by these means that the Bruchid was still present at the time of writing, though the frequency and intensity of the infestations had diminished. It was found in one plot almost two miles from the nearest source of infestation and in a cage placed on a hill at about 330 ft. altitude. No infestation was found in cages or plots $1\frac{1}{4}$ or $2\frac{1}{2}$ miles outside the infested zone. In laboratory experiments, the beetles preferred white to coloured light, but none was taken in light-traps in the field. No new food-plants were recorded during the investigations, but *B.* (*Acanthoscelides*) *obreptus*, Bridwell [see preceding abstract] was bred from cowpeas.

[Waterston (J. M.).] **Plant Pathology.**—*Rep. Dep. Agric. Bermuda 1942* pp. 8–9. [Hamilton] Bermuda, 1943.

In a brief section dealing with insect pests in Bermuda in 1942, excellent control of cutworms, which were destructive to vegetables in autumn, is reported from a bait of 4 lb. Paris green and 2 gals. lubricating oil (S.A.E. 20–30) in 100 lb. bran. *Ceratitis capitata*, Wied., was seen to oviposit in fruits of *Passiflora edulis*, but the eggs did not develop and damage was limited to the formation of small protuberances on the fruits. No new pests were recorded

during the year, damage to stored potatoes by *Gnorimoschema operculella*, Zell., was unimportant, and no interceptions of *Popillia japonica*, Newm., were made [*cf. R.A.E.*, A **30** 608].

[Shapiro (L.).] **Шапиро (Л.).** *Ptinus tectus* **Boield.** [*In Russian.*]—*Sprav. Vop. Karant. Rast.* no. 3 pp. 1–4, 3 figs. Moscow, Tzentr. karant. Lab., 1941. [Recd. 1944.]

The first record of *Ptinus tectus*, Boield., in the Russian Union was in Leningrad in 1926, when it was found infesting ants' pupae stored for medicinal use. It was later observed in pearl barley from Latvia and in stored casein and albumen in Leningrad and Finnish Karelia. In view of the possibility of further infestations occurring, its distribution and biology are reviewed, all stages are briefly described, and instructions are given on methods of inspecting storehouses and examining stored products.

[Chernuishev (P. K.).] **Чернышев (П. К.). The Rice Pyralid.** [*In Russian.*]—*Sprav. Vop. Karant. Rast.* no. 3 pp. 4–7, 9 figs. Moscow, Tzentr. karant. Lab., 1941. [Recd. 1944.]

Since the rice moth [*Corcyra cephalonica*, Staint.] was found in 1939 in the ports of Leningrad and Murmansk infesting cacao beans from West Africa, detailed descriptions are given of the adults, larvae and pupae of this Pyralid, and its geographical distribution, economic importance, bionomics and control are reviewed from the literature.

[Chochiya (A. S.).] **Чочия (А. С.). Propagation of** *Sympherobius* **in Abkhazia.** [*In Russian.*]—*Sprav. Vop. Karant. Rast.* no. 3 pp. 7–9. Moscow, Tzentr. karant. Lab., 1941. [Recd. 1944.]

During 1939 and 1940, *Sympherobius* [*amicus*, Nav.], which is predacious on mealybugs in Palestine [*cf. R.A.E.*, A **16** 630] was bred in the laboratory in Abkhazia for release against the citrus mealybug [*Pseudococcus gahani*, Green] and the grape-vine mealybug [*P. citri*, Risso]. The best results were obtained by rearing it in small muslin cages containing boxes of potato sprouts infested with the mealybugs, and 46,525 adults were obtained by this method from January to September 1940. Most of them emerged in May and June, and the subsequent drop in production was probably due to the excessive atmospheric humidity in the insectary, which sometimes reached 95–98 per cent.

In 1939, 4,325 larvae and adults were released under muslin frames against *P. gahani* on *Citrus* and *P. citri* on grape vines. A small increase in the numbers of the Hemerobiid was observed in both cases, and the numbers of mealybugs on *Citrus* fruits on the experimental trees was reduced by 10–50 per cent. It was not, however, recovered in the spring of 1940 from any of the plots. During 1940 it was released on a more extensive scale in the districts of Sukhum and Gagrui, and increased considerably in abundance, but its effectiveness in destroying the mealybugs could not be estimated, since *Cryptolaemus* [*montrouzieri*, Muls.] was also present.

During the winter of 1939–40 and the spring of 1940, the egg, larval and pupal stages lasted 5–9, 9–13 and 9–16 days, respectively, in the insectary, and the adults survived for 15–19 days. Females did not oviposit unless fertilised, and supplementary feeding was essential. They laid from 86 to 272 eggs, with an average of 174. Mortality among the eggs ranged up to 38 per cent., and that among the larvae and pupae to 39 per cent. On the average, a female gave rise to 66 adult progeny. Females constituted 32–44 per cent. of the individuals reared in flasks, but appeared to represent only 22–31 per cent. of those bred by mass methods in the insectary, though this may have been because they

tended to congregate in dark places and were difficult to count. In the absence of mealybugs, the adults fed on the eggs, but the larvae did not attack each other.

[Belyakov (V.).] **Беляков (В.). The Bamboo Scale in Georgia.** [*In Russian.*] —*Sprav. Vop. Karant. Rast.* no. 3 p. 9. Moscow, Tzentr. karant. Lab., 1941. **On *Icerya purchasi* Mask., its Predator, *Vedalia* (*Novius*) *cardinalis* Muls., and new Foci of Infestation.** [*In Russian.*]—*T.c.* p. 10. [Recd. 1944.]

It is stated in the first of these notes that the recent increase in the cultivation of bamboo in western Georgia has resulted in the spread of the bamboo scale [*Asterolecanium bambusae*, Boisd.] and that it has been introduced with planting material into eastern Georgia and Azerbaijan, where it is also spreading. The existing quarantine regulations should, therefore, be revised; fumigation of nursery stock with hydrocyanic acid gas has not proved effective. *Cryptolaemus* [*montrouzieri*, Muls.] gave promising results in experiments, and since this Coccinellid has been successfully used near Tiflis against the vine mealybug [*Pseudococcus citri*, Risso] on grape vines, it would probably survive there on bamboo.

In the second note, the author records that *Icerya purchasi*, Mask., which is one of the pests subject to internal quarantine in the Russian Union, has recently been found at Ochemchiri, on the coast of Abkhazia, and at Sochi, and recommends an extension of the use against it of *Rodolia* (*Vedalia*) *cardinalis*, Muls. [*cf. R.A.E.*, A **24** 675].

[Arkhangel'skiĭ (G.).] **Архангельский (Г.). Additional Note on the Uzbek Cerambycid.** [*In Russian.*]—*Sprav. Vop. Karant. Rast.* no. 3 p. 10. Moscow, Tzentr. karant. Lab., 1941. [Recd. 1944.]

The so-called Uzbek or urban Cerambycid [*Aeolesthes sarta*, Solsky] has become prevalent in north-eastern Uzbekistan since 1924–25, when it was introduced with timber into Tashkent, and is now a serious pest of forest, orchard and ornamental trees. It is common on elm, caused severe damage to birch in 1939-40, and has recently been recorded as attacking apricot. It increases rapidly, kills many trees each year, and has spread to the north and north-east of Tashkent into the adjoining area of Kazakstan. Quarantine measures should be enforced to prevent its introduction into the Caucasus with timber from Central Asia.

[Egorov (P. I.) & Khasapova (E. I.).] **Егоров (П. И.) и Хасапова (Е. И.). Tests of the Residue of Distillation of Nitrochlorbenzol as a Soil Fumigant.** [*In Russian.*]—*Sprav. Vop. Karant. Rast.* no. 3 pp. 19–20. Moscow, Tzentr. karant. Lab., 1941. [Recd. 1944.]

An account is given of preliminary field tests carried out in early August 1940 near Odessa on the use as a soil fumigant against *Phylloxera* [*vitifoliae*, Fitch] on vines of the residue from the distillation of nitrochlorbenzene. It is a cheap by-product of the aniline industry, and contains 50–75 per cent. orthonitrochlorbenzene, 7–10 per cent. dinitrochlorbenzene, and 10–15 per cent. tarry products. Dichlorethane was used for comparison.

The fumigants were introduced into the soil to spade depth in holes 40 cm. apart, at rates of 200–1,000 gm. per sq. m. [equivalent to approximately 6–30 oz. per sq. yd.]. The aerial parts of the vines were examined on 1st September, and the roots in mid-October. The results, which are tabulated, showed that both fumigants were ineffective at 200 gm. per sq. m. At 400 and 600 gm. dichlorethane killed all Aphids to depths of 80 and 100 cm., respectively, and the residue to depths of 100 and 140 cm. (the lowest level at which the roots

occurred), but some of the roots died off to a depth of 50 cm. At higher rates of application, both fumigants were completely effective but killed more of the roots, the residue in all cases being the less injurious.

When the crowns of the vines were uncovered, the fumigants poured on them, and the soil replaced, both were ineffective at 300 gm. or less per plant and killed the stems and roots at 400 gm. or more.

ARNOLDI (K. V.). **On the Oecology and Biocoenology of *Eurygaster integriceps* when hibernating in the Basin of the Kashka-Darja River.**—*C. R. Acad. Sci. URSS* (N. S.) **35** no. 6 pp. 189–192. Moscow, 1942. [Recd. 1944.]

Eurygaster integriceps, Put., breeds extensively on cereals in the valley of the Kashka-Dar'ya, in south-western Uzbekistan, at an elevation of about 2,000–3,000 ft., but the bugs leave the valley in June and pass the summer high up in the mountains. They either remain there during the winter or descend in autumn to the lower slopes for hibernation. Observations on the hibernation quarters of the bugs were made during the winter of 1941–42, and a detailed account is given of the results and of the animal and plant communities with which the bugs were associated. A few individuals were found at over 9,000 ft., but the majority occurred at altitudes of 4,900–6,250 ft., in the lower part of the juniper belt. The bugs mostly sheltered under low bushes and shrubs and were protected in winter by snow.

List of Pests, Diseases and Weeds of agricultural Crops subject to external Quarantine instituted for the U.S.S.R. for the Year 1940. [*In Russian.*]—La. Cr. 8vo., 62 pp. Moscow, Izd. tzentr. karant. Lab., 1940. [Recd. 1944.]

The pests (chiefly insects) are arranged under the crops affected, and brief notes are given in each case on food-plants, geographical distribution, the plants or plant products that require inspection, and the quarantine measures that should be adopted. Indices to the Russian and scientific names of the pests, diseases and weeds are also given.

SPEYER (E. R.), PARR (W. J.) & ORCHARD (O. B.). **Animal Pests.**—*28th Rep. exp. Res. Sta. Cheshunt 1942* pp. 48–61. Cheshunt, Herts., 1943.

Further experiments on the control of *Tetranychus telarius*, L., on greenhouse tomatos are described by Speyer [*cf. R.A.E.*, A **31** 177]. Sprays of 2 and 4 lb. tartar emetic with 3 gals. glycerine in 100 gals. water killed only 60 and 73 per cent. of the active stages and 50 and 86 per cent. of the resting stages and severely injured the foliage. When the glycerine was omitted, the corresponding percentages were 47, 61, 50 and 24, but the foliage was not damaged. Glycerine alone gave no mortality and caused considerable injury at 1 : 400, and killed 60 per cent. of the mites, with severe injury to the foliage, at 3 : 100. Similar results were obtained when cane molasses or flour paste was used with tartar emetic at the rates of 1 gal. and 4 lb., respectively, per 100 gals. Concentrations of tartar emetic up to 10 lb. per 100 gals. did not injure the foliage but gave no increased mortality of the mites. The addition of wetting agents to sprays of tartar emetic or glycerine tended to reduce mortality, and none of the sprays was toxic to the eggs. Observations on tomato plants and leaves bearing the dry deposits from sprays of 2–10 lb. tartar emetic and 1 gal. cane molasses or 4 lb. flour paste per 100 gals. water indicated that tartar emetic has little action as a stomach poison. Solutions containing a compound of antimony analogous to tartar emetic with wetting agents of the sulphonated type gave mortalities of 60–100 per cent. with slight to severe injury to the foliage, but their action was due mainly to the wetting agent, the addition of the antimony compound increasing mortality by only 3–8 per cent. Observations on the effect of burning sulphur or fumigating with naphthalene after the mites have

begun to enter their winter quarters (mid-September) were made in commercial glasshouses in October. Broadcasting naphthalene was ineffective at this time of year, when temperatures above 70°F. cannot be economically maintained, and burning sulphur and volatilising naphthalene from lamps did not give sufficient mortality to prevent infestation in the following season.

Speyer & Parr record observations on the reactions of wireworms of the genus *Agriotes* to baits, carried out in a glasshouse near Berwick. When large slices of carrot were placed in the soil and examined at intervals of 4 days, there was no decrease in the numbers taken in three collections. Appreciable numbers did not assemble at the baits until 3 days after they were set. Few larvae tunnelled into the carrots, and the latter appeared to become more attractive after they had been in the soil for a week. The effect of a high population on lettuce growing in the soil of a glasshouse was investigated at Cheshunt during January–April, and it was found that wheat sown between the rows of lettuce, afforded considerable protection as soon as it germinated, and that when plants destroyed by the larvae were replaced, established plants in the vicinity were protected to some extent, although successive replacements were destroyed. If 3–5 days elapsed before attacked plants were replaced, most of the larvae left the sites while they were unoccupied, and disturbing the soil beneath the roots of attacked plants also caused them to move away. More plants were destroyed when they were set on ridges than when they were on level soil, and it is concluded that the larvae can move more rapidly in loose than in more firmly consolidated soil; they also showed a preference for the warmer parts of the soil.

Orchard gives a note on *Phytomyza solani*, Macq., which has been established on tomatos in a few nurseries for many years, but caused little loss since it did not attack the plants until the first four or five trusses had been gathered. Of recent years, however, it has attacked seedling plants in many nurseries and has been sufficiently injurious to constitute a potential major pest. Injury is most severe when the adults emerge from the overwintering puparia before the seedlings have produced true leaves, since eggs are then deposited on the leaves as these develop and the growing point may be damaged. Frequently infestation does not begin until the plants have been set out in the houses or until the end of April or beginning of May, and it is then generally less injurious, though so much foliage may be mined that crops may be destroyed by the end of July or August. The larvae cannot be controlled by insecticides alone, except at concentrations injurious to the plants, particularly if these are young. When infestation of seedlings is severe, daily applications of an atomised spray containing 1 oz. nicotine in 2 gals. water is recommended against the adults. Nicotine dusts are also satisfactory. The use of insecticides should be supplemented by the destruction of infested cotyledons. If the plants become infested several weeks after planting out, infested leaflets should be destroyed and the plants sprayed every ten days with nicotine at a dilution of 1 oz. in 4 gals. water with a wetting agent. When spraying with oil emulsion against *Tetranychus telarius* is begun, the nicotine can be incorporated in the oil sprays.

Papers noticed by Title only.

Ghilarov (M. S.). **Parallelisms in the Formation of Entomocoenoses of Grain Fields in eastern Europe and North America.**—*C. R. Acad. Sci. URSS* (N.S.) **38** no. 1 pp. 44–46, 7 refs. Moscow, 1943. [English Translation. See *R.A.E.*, A **31** 519.]

Volkonsky (M. T.). **Rearing Locusts in Captivity.** [Notes on experience in Algeria, particularly with *Schistocerca gregaria*, Forsk., and *Anacridium* spp.]—*Bull. ent. Res.* **34** pt. 4 pp. 253–256. London, 1943.

Sampson (W. W.). **A Generic Synopsis of the Hemipterous Superfamily Aleyrodoidea.**—*Ent. amer.* **23** no. 3 pp. 173–223, 37 refs. Lancaster, Pa., 1943.

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